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ABSTRACT

Provided are teaching activities related to: (1) food production and distribution; (2) energy; (3) transportation; (4) solid waste; (5) chemicals in the environment; (6) resource management; (7) pollution; (8) population; (9) world linkages; (10) endangered species; and (11) lifestyle and environment. The activities, designed to help learners better understand the relationships between their actions and the world environment, focus on cultural linkages and demonstrate the overt and covert interdependencies among the nations of the world and between people and systems. In addition, they can help bring about an awareness of the many ways in which local actions have far-reaching effects on people in other parts of the world, and conversely, how worldwide problems have different effects on different regions. It is also intended that the activities build a global orientation into the learner's daily life, and empower individuals to act in accordance with this orientation. Each activity includes a statement of purpose, recommended educational level, subject area (science, mathematics, social studies, fine arts, language arts, home economics, and other areas), concept(s) fostered, reference(s), and when applicable, list of materials needed. (JN)

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SELECTED AND DEVELOPED BY
LORI D. MANN AND WILLIAM B. STAPP

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THINKING GLOBALLY AND ACTING LOCALLY: ENVIRONMENTAL EDUCATION TEACHING ACTIVITIES

ERIC® Clearinghouse for Science, Mathematics
and Environmental Education
The Ohio State University
College of Education and
School of Natural Resources
1200 Chambers Road, Third Floor
Columbus, Ohio 43212

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ENVIRONMENTAL EDUCATION INFORMATION REPORTS

Environmental Education Information Reports are issued to analyze and summarize information related to the teaching and learning of environmental education. It is hoped that these reviews will provide information for personnel involved in development, ideas for teachers, and indications of trends in environmental education.

Your comments and suggestions for these publications are invited.

John F. Disinger
Associate Director
Environmental Education

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PREFACE

This is the 17th volume in ERIC/SMEAC's Teaching Activities in Environmental Education series, which was initiated in 1973. The first three titles in the series were of a general nature, dealing with multiple aspects of environmental education. Starting with the fourth, topical areas have been identified as themes, with the expectation that such an organizational pattern might prove more useful to practitioners in both formal and non-formal settings.

As a general rule, most of the activities selected for inclusion in the various volumes have been adapted from materials developed by others; many of the source publications have been reported through the ERIC data base, and are available as ERIC documents. Some have been "original," in the sense that ERIC staff or other authors have developed them more or less from scratch. Common formats have been employed for all activities in each volume.

The current volume was developed by Lori D. Mann and Dr. William B. Stapp, with the assistance of graduate students in the Behavior and Environment Program at The University of Michigan. Activities include a mix of original and adapted materials.

Other titles in the Teaching Activities in Environmental Education series include:

John H. Wheatley and Herbert L. Coon, One Hundred Teaching Activities in Environmental Education. 1973; ED 091 172; 204 pages.

John H. Wheatley and Herbert L. Coon, Teaching Activities in Environmental Education, Volume II. 1974; ED 102 031; 200 pages.

John H. Wheatley and Herbert L. Coon, Teaching Activities in Environmental Education, Volume III. 1975; ED 125 268; 195 pages.

Herbert L. Coon and Michele Y. Alexander, Energy Activities for the Classroom. 1976; ED 130 833; 148 pages.

Herbert L. Coon and Mary Lynne Bowman, Environmental Education in the Urban Setting: Rationale and Teaching Activities. 1977; ED 137 140; 199 pages.

Judith M. Schultz and Herbert L. Coon, Population Education Activities for the Classroom. 1977; ED 141 178; 195 pages.

Robert H. McCabe, J. Terence Kelly, and Doris Lyons, Man and Environment Teaching Activities. 1977; ED 144 626; 336 pages.

Herbert L. Coon and Charles L. Price, Water-Related Teaching Activities. 1977; ED 150 026; 156 pages.

Mary Lynne Bowman and John F. Disinger, Land Use Management Activities for the Classroom. 1977; ED 152 541; 265 pages.

Mary Lynne Bowman and Herbert L. Coon, Recycling: Activities for the Classroom. 1978; ED 159 075; 145 pages.

William R. Hernbrode, Multidisciplinary Wildlife Teaching Activities. 1978; ED 162 897; 95 pages.

Herbert L. Coon and Mary Lynne Bowman, Energy Activities for the Classroom, Volume II. 1978; ED 173 072; 165 pages.

Mary Lynne Bowman, Values Activities in Environmental Education. 1979; ED 182 118; 134 pages.

Charles E. Roth and Linda G. Lockwood, Strategies and Activities for Using Local Communities as Environmental Education Sites. 1979; ED 194 349; 207 pages.

Mary Lynne Bowman, Teaching Basic Skills through Environmental Education Activities. 1979; ED 196 704; 132 pages.

Mary Lynne Bowman, Teaching Natural Resources Management through Environmental Education Activities. 1981; ED 214 752; 206 pages.

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ABOUT THE AUTHORS

Lori D. Mann holds a Master of Science degree in Environmental Instruction from The University of Michigan, School of Natural Resources, and is currently the Education Director at the Coyote Point Museum for Environmental Education in San Mateo, California.

William B. Stapp is Professor of Natural Resources and Chairperson of the Behavior and Environment Program, School of Natural Resources, The University of Michigan. He served as first Director of Unesco's International Environmental Education Program, and is past-President of the American Nature Study Society, President-elect of the National Association for Environmental Education, and recent recipient of a Senior Fulbright Fellowship to Australia.

INTRODUCTION

It has become increasingly clear that we live and operate within a global system. Many of the environmental problems facing our world today are the result of individual decisions, often made without consideration of their extended effects. In recent years, modern technologies have multiplied many fold the environmental impact of any action taken on the individual, national or international level. A decision to install solar panels or the most advanced pollutant screens--technologies not available a relatively short time ago--has tremendous potential impact on the world environment. Similarly, the potential destruction of a nuclear bomb is awesome compared to weapons of a hundred years ago. Transport of foods in refrigerated vehicles has dramatically changed diets and agricultural practices around the globe, and a multitude of electrical appliances where there once were none has placed an increasing drain on the earth's limited resources.

As a result, decisions that were once made in relative isolation now touch the lives of millions of people, to say nothing of a countless number of other living species. Each action, no matter how small, now reverberates across a complex web of reactions and repercussions. From selecting a brand of canned vegetables to financing mining operations on the ocean floor, each decision now has ramifications far beyond those readily apparent.

Thus, environmental problems no longer conform to political boundaries. Concerns that were once limited to local areas are now global in scope. Dwindling resources, acid rain, population increase, world hunger, and nuclear proliferation are among the issues that now dominate the environmental concerns of the day.

It follows that progress toward resolving these issues comes at least in part through an awareness of the interdependence of all the systems of the earth. We are moving into an era in which the global perspective is no longer a luxury. We no longer have the option of foregoing consideration of the worldwide impacts of our lifestyles, our cultures, and our governmental policies. This knowledge, with the tools and motivation to act upon this information, is a critical step toward world security.

Despite its promise, however, the incorportion of a global perspective into educational efforts is no small task. The obstacles preventing development of a unified vision of the world environment have deep roots in cultural, political, and social ideologies. Tradition is a strong impediment to changing ideas, and delays the incorporation of new attitudes and approaches into existing patterns. Governments, schools and other social institutions are often resistant to change, reinforcing the role of traditional values and making acceptance of a new perspective even more difficult.

The feeling of separation of nations has long been perpetuated through media, education, news reporting, and other means. In examining world resources, the common view has been "ours" and "theirs," as defined by somewhat arbitrary political lines. The undeniable interconnections of ecological systems has rarely been promoted as the basis for resource management.

In the United States in particular, our inherent wealth of resources and, to an extent, our physical separation from most other countries have led us to strive for independence on a planet constituted of intricate linkages. Political ideologies, language differences, and the quest for power have often led us to put national interests above global issues. We are rightfully concerned with the protection and promotion of our own country's resources, but we can no longer afford to do this at the expense of our role as a global influence.

The formal educational systems of this country also serve to delay the incorporation of a global perspective into the common frame of reference. Though organizations such as Global Perspectives in Education are making great strides in changing existing attitudes, there is a strong tendency to emphasize differences rather than similarities, and to transmit traditional ideas regarding the separation of political and cultural ideologies. Many social studies programs, for example, deal pointedly with the ways in which other cultures differ from our own. Many programs stress the fact that we are a progressive, resource-rich nation and unintentionally promote the concepts that less developed countries are in some way backwards and less capable than our own.

This existing pattern in educational efforts is in part due to a lack of adequate preparation in dealing with world linkages in the professional training of teachers. University requirements are slow in reflecting accelerating needs to understand current world affairs and to recognize the importance of integrating international information and perspectives into existing courses. Future teachers are often not prepared to emphasize the oneness of the world, to incorporate global concepts into virtually any discipline, or to illustrate cross-discipline linkages.

The world environment is an ideal arena in which to begin to break down these attitudes, as it is readily apparent that the actions of one nation affect the environmental quality of the rest of the world. The effects of United States industrial effluents on acid rain levels in Canadian lakes is clear. Our need to import oil from Canada, the United Kingdom, and nations in the Middle East and Latin America exemplifies the environmental ties between various regions of the world, and our exported pesticides come back to us in vegetables, meat, and dairy products. This in turn will influence agricultural patterns over time, showing again how environment, culture, economy, and politics are inexorably linked. If world security and a more equitable distribution of world resources are ever to be realized and maintained, we must understand our resource base and not abuse and over-exploit our resources. Thinking globally means recognizing that we are part of the global system, and that we must take responsibility for its maintenance. It also calls for the development of a more elaborate system of information-sharing and communication among nations.

The barriers to incorporating this perspective into daily patterns of thinking and acting are deeply rooted and difficult to overcome without diligent effort. They are not, however, insurmountable. Global environmental education is a significant step toward the necessary understanding of world linkages. With global environmental education, we can begin to account for our impact on the world environment. World security literally depends on building a respect for all nations and cultures, and recognition that people the world over have equal rights to adequate resources and environmental quality. Building a global outlook into virtually all existing daily patterns is an essential part of refueling our spirits and finding solutions to our world problems.

The ultimate challenge of environmental education, then, is to bring students of all ages to that critical understanding of the oneness of the earth. As educators, we have the capacity to assist individuals in seeing the world in its global context, and to provide the tools to act with that global perspective in mind. We are in a position to nurture the international exchange of ideas and information that could result in an increasing awareness of the interconnectedness of ecologic, economic, political, and social systems. It is a role of growing importance; the result of increased global environmental education efforts can only be a world of greater understanding, acceptance and security.

The Objectives of This Book

The strategies for breaking down these well-established barriers to global education are varied. As environmental educators, it is our responsibility to contribute to this effort in the most constructive manner possible. Our efforts in both formal and nonformal settings touch the lives of many individuals who, generating outward, influence the actions and attitudes of countless others. We have the opportunity to help in building a world citizenry that has the awareness, knowledge, commitment, motivation, and skills to make decisions that account for our impact on the world environment, and to build global perspectives through the use of reinforcing learning environments.

Much is occurring internationally to promote global environmental education. United Nations conferences on a wide range of topics such as desertification, population, and resource development are acknowledging the importance of education as an integral part in finding solutions to world environmental problems. Also, over the past decade an exciting series of regional meetings sponsored by the United Nations have focused directly on the development of worldwide strategies and action programs designed to further environmental education in all sectors of the world.

These programs are making invaluable contributions to the growth of global perspectives. They are bringing about significant changes in the quality of the world environment. However, such programs operate on very large scales, and can appear irrelevant to some individuals. It is the task of global environmental educators to find ways of scaling down such ideas to levels that are tangible to each world citizen.

Educational research indicates time and time again that the most effective educational strategies are those that relate directly to the learner's life. Thus, dissecting the overwhelming issues facing the world today and bringing them to a level that has direct pertinence to the individual is a necessary element in effective global environmental education. To this end, activities that link personal and local actions to their positive and negative global implications are among the most significant methods of nurturing a global environmental ethic in individuals. It is also an effective strategy for developing a global consciousness and a stewardship--not just of the learner's own land, but of the world as a whole.

Thus, it is the aim of the authors to provide educators with a series of tested activities that help learners to better understand the relationships between their actions and the world environment. These activities focus on cultural linkages and demonstrate the overt and covert interdependencies among the nations of the world and between people and systems. The materials presented here can help to bring about an awareness of the many ways in which local actions have far-reaching effects on people in other parts of the world, and conversely, how worldwide problems have different effects on different regions. It is also intended that these activities build a global orientation into the learner's daily life, and empower individuals to act in accordance with this orientation.

Several steps were taken to ensure the maximum benefit of the materials presented in this volume. First, a special effort was made to include activities that are appropriate to both formal and nonformal audiences from upper elementary school through adult age levels. Material has been provided in many disciplines ranging from art to science, so as to demonstrate the applicability of global thinking to virtually any subject, theme, or educational arena.

The global perspective is just that--a perspective. It is not a subject to be added to an already overcrowded curriculum. Thus, this volume was designed to use existing materials and to revise them to bring forth a global orientation, at the same time retaining their original intent. Much excellent work went into the original design of the activities included herein, and it is the authors' desire only to enhance the value of these lessons. The primary purpose of these activities remains teaching about food distribution, chemicals in the environment, or any of the other topics included, but to do so in a manner that clearly links the subject to the world environment. Thinking globally, and acting locally, allow the learner to become involved with tangible community actions that can have a positive effect on improving the world environment.

The Process and Design of This Volume

The steps involved in the development of this volume date back to mid-1981, when the Environmental Education Advisory Board of the ERIC Clearinghouse for Science, Mathematics, and Environmental Education made a recommendation to emphasize the importance of global environmental education in projected Environmental Education Information Reports. Two projects resulted: this volume of teaching activities, and a complementary volume, Environmental Education in Action V: International Case Studies in Environmental Education, by Margaret E. Cowan and William B. Stapp, summarizing successful and innovative programs from more than 40 different locations around the world.

ERIC/SMEAC helped to identify and provide valuable materials for a literature review that focused on approaches to global environmental education, and helped to identify constraints and barriers. One result of the literature search was the discovery of an apparent gap in the availability of activities that provided a global orientation with regard to the environment. Much excellent material exists which focuses on cultural linkages and exchanges. Population issues, too, are well covered. Material that extends itself to other topics of environmental concerns, however, is sparse. Hence, a decision was made to provide a series of activities to fill this gap.

Themes were established to include traditional and innovative areas of study that could cross many disciplines and serve as approaches on varying levels of complexity to accomodate various age levels. It was also important that these themes be readily adaptable to the basic premise of thinking globally and acting locally, or areas in which compounded personal decisions have tremendous environmental impact.

An extensive review of available resources uncovered about 100 excellent activities in these categories that could be edited to bring forth the global perspective sought. These activities were then carefully revised.

The aim of making revisions was to provide materials that could help overcome some of the barriers to incorporating a global perspective while remaining true to the ideals of quality environmental education. As they now stand, these activities stress similarities between cultures rather than differences. They provide clear pictures of the interconnections of systems and people, and the relationships between nations. In addition, they are geared to actively involve the learner, to challenge deductive thinking, and to clarify values regarding personal actions and the world environment. The activities are also constructed to motivate action; in virtually every case, a step is included to involve learners in examining how their own behavior impacts people and/or the environment in other parts of the world. This process can help to build a world of concerned and committed people with the knowledge that local actions and personal decisions do affect others, and that each individual therefore has a role in creating solutions for ecological, political, and social problems.

More specifically, some of the techniques used to incorporate global perspectives in these activities include: (1) working a representative from another country or from an international organization into a role-play situation, (2) incorporating exchange and comparison of information with a group of similar age in another area, and (3) broadening discussion to include consideration of impacts on other nations or reactions of citizens applicable to a wide variety of existing activities.

Finally, activities have been included on a diverse array of subjects: Food Production and Distribution; Energy; Transportation; Solid Waste; Chemicals in the Environment; Resource Management; Pollution; Population; World Linkages; Endangered Species; and Lifestyle and Environment.

Each category and each activity has been selected because of its timeliness to global environmental concerns and actions, its importance to the quality of the world environment, and its relevance to the concept of thinking globally and acting locally. For example, it is true that compounded personal decisions regarding the multitude of issues surrounding childbirth create, at least in part, the population problems of today. Similarly, personal and industrial demand for fuel are partly responsible for the current shortage of energy resources and the environmental hazards of pursuing available resources to the extreme. And choices regarding the use of chemicals in the home influence the degree of toxic contamination of world groundwater sources.

The wide variety of topics addressed indicates the viability of incorporating a global perspective into almost any existing environmental education effort. It is not suggested that these materials are all-inclusive, for virtually every decision we make somehow touches the world environment.

Housing, utilities, solid waste, lawn care--all of these, and more, are areas in which we make personal decisions that have far-reaching effects. With global environmental education, and more specifically learning to think globally while acting locally, we can become accountable for our impact on the world environment.

By providing these activities, it is the expressed hope of the authors that an increasing number of educators--in schools and out of schools--will be moved to begin work with a global orientation. There is undebatable need for increased global environmental education, for increased respect for the world environment. We are in a critical position to assist in building a world citizenry that understands and acts responsibly upon the critical truth of the oneness of the world. It is a time of fast changes and widespread influence, and every action counts. We can help change the world environment while living at home--if we care, and act accordingly.

The authors wish to credit numerous global-thinking educators for some of the ideas brought forward in this volume. Graduate students at the University of Michigan have helped in researching some of the material presented, and the ERIC system has contributed valuable assistance in providing resources and support for this project.

FOOD PRODUCTION
AND DISTRIBUTION

PURPOSE: To compare daily food intake with children of another country.

LEVEL: Upper elementary.

CONCEPT: People in different countries have different sources of nutrition.

SUBJECT: Social Studies, Health.

REFERENCE: Developed by Susan Bradford, Norton Fogel, Larry Graff, Dave Heberholz, Lori Mann, Kathleen Standen, Paul Zeph, University of Michigan, School of Natural Resources.

MATERIALS: List of foreign contacts, Dietary Intake Sheets, Poster board, stationery, postage, food group chart.

PREPARATION FOR THE ACTIVITY:

1. The teacher contacts a foreign classroom of the same age level. The foreign teacher simultaneously follows the same program outline.

ACTIVITY:

1. Ask students to keep a food diary for a 5-day school week on the provided dietary intake sheets.
2. Post the diaries on a classroom bulletin board for comparison.
3. Hold a classroom discussion comparing students' dietary intake.

   Discussion Questions:

   a) Which foods would be missed most if they were not available?
   b) Which and how many of these foods are grown in your country?
   c) Can just the foods grown in your country provide adequate nutrition?
   d) Does any sort of dependence of food on a global scale begin to appear?

4. Have students write letters establishing correspondence with foreign students. Distribute one letter and dietary intake sheet from a foreign student to each student in the class.

5. Each student brings in a sample of one of the most common foods listed in his/her letter from the foreign student. As an alternative, a list can be made of foods most commonly eaten in the foreign country.

6. Compare and discuss the foods consumed by foreign students with those consumed by students in the class.

7. Using a food group chart, determine which foods eaten by both student groups provide the most nutritional value for those students.

DISCUSSION:

1. Where are the most nutritional foods grown?
2. How much do both classrooms rely on imported nutritional foods?
3. Can locally grown and produced foods be substituted for those that are imported?
4. How does food flow internationally (between countries)?

FOOD DIARY

Record all the food you eat this week. By reading labels and asking supermarket employees, determine whether each food they eat is produced within their state (Local - L), elsewhere in the United States (National - N), or in a foreign country (F) and check the appropriate column.

Monday				Tuesday				Wednesday				Thursday				Friday			
Food Items	F	N	L		F	N	L		F	N	L		F	N	L		F	N	L

PURPOSE: To examine staple food growth and distribution around the world.

LEVEL: Upper elementary

SUBJECT: Social Studies

CONCEPTS: Certain food crops are produced in greater amounts than others.

Different staple food crops are grown in different parts of the world.

There is a widening gap in many countries between the amount of food grown and the amount of food needed.

The choices individuals make about the grains they use have world-wide impacts.

REFERENCE: Parker, et al., 1981, p. 149-156; Parker, et al., 1982, p. 159-162.

MATERIALS: Set of worksheets for each participant.

ACTIVITY:

1. Distribute set of worksheets to each participant. (The activity can easily be done in pairs.) Interpret the information and answer questions as presented.

DISCUSSION:

Use the Background Information for Teachers to guide additional discusssion on the relationship between population and food production.

NOTE: The Worksheets (pages 7-14) and Background Information (pages 15-18) are copies of materials prepared for, and used by, students and teachers in Zimbabwe, and are reprinted by permission of the authors.

UNIT 26

AGRICULTURE

cash crops: cotton and tobacco.
monocultivation. pests. protein, oil and cereal crops.
storage of raw food. cattle management.

world food crops. food crops in zimbabwe.
citrus. small scale mixed farming.
land preparation. fertility trench. mulching.

food plants in the garden.
livestock. poultry.

fresh water fish.

animal products.
useful insects.

plants use up water.
soil soaks up water.

earth. seeds. food.

Main food crops of the world

Skills
Interpretation of graphs and maps, investigating foods.

Science vocabulary
Annual, yield, staple, estimate, population, husk, scar. Names of various crops and places in the world.

Main ideas
1. Certain food crops are produced in greater amounts than others.
2. Different staple food crops are grown in different parts of the world.
3. There is a widening gap in many countries between the amount of food grown and the amount of food needed.

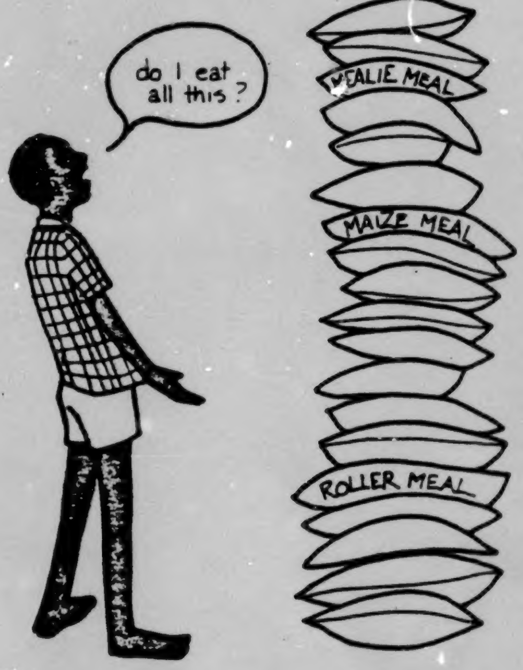
What pupils will be able to do by the end of Unit 26
1. Name the four main staple food crops grown in the world.
2. Write five statements of fact about rice and five about potatoes.
3. Identify parts of the potato and rice plant that are used by man for food and demonstrate that these contain food.
4. Interpret maps showing where crops are grown by answering questions. (pages 128-131 Group Activity Book)
5. Explain what the graphs on page 132 of the Group Activity Book show.

Introductory Activity

We need a great deal of food

Ask pupils which is their *main* food, i.e. do they eat more bread than maize meal or vice versa. Bread comes from wheat, maize meal from maize. These are important crops for feeding millions of people. These basic foods are known as *staple foods* and they form the main part of our diet. Rice and potatoes are staple foods in other parts of the world.

Try to get across an idea of the enormous amount of food each person needs, a country needs and the world needs. Bring a 5 kg bag of mealie meal into the classroom. Ask how long this will last one full grown hard working man. (Perhaps one to two weeks.) How many will he need in a year? (Work it out). Perhaps a family of 6-8 people would need 1 000 kg of mealie meal in one year, i.e. 1 tonne.



Do some calculations:
Say there were 700 000 families living in Zimbabwe : how much maize meal would the country need in one year? (700 000 tonnes)

That is getting on for 1 million tonnes for one small country.

What about the rest of the world? (and of course here we have only talked about one of our staple foods.) People need other foods too. Remind pupils that all of the food we eat originally comes from plants.

Suggested Activities

MAIN IDEA: Certain world food crops are produced in greater amounts than others

1. Let your pupils look at the bar chart on page 126 of the Group Activity Book on 'Annual Production of Plant Foods' and answer the questions.

Answers to Questions

1. Wheat, rice, maize, potatoes.
2. In fact all the plants given in the list are grown in Zimbabwe with the exception of coconut. This is grown in coastal tropical regions.
3. More bananas than groundnuts are grown. Point out, however, that this bar chart is a comparison of mass. Groundnuts do not have much water in the nut, whereas bananas do—their fruit is fleshy. Groundnuts are dry.
4. About 360 million tonnes of wheat are grown annually.
5. Nearly 50 million tonnes of soya beans are grown annually.
6. More rice than maize is grown in the world.

Use the above for discussion. Tell the pupils to think of other questions based on the chart to ask each other.

2. Information on maize, sorghum, groundnuts, sugar cane, wheat and sunflowers is given in 'Crops of Zimbabwe' (Unit 21). Let pupils study pages 126-127 of the Group Activity Book to find out about *rice* and *potatoes* and answer the questions.

Answers to Questions about the Table, page 128.

1. Japan
2. 116 kg/ha
3. None
4. Thailand
5. Japan
6. For high rice yields it is necessary to apply large amounts of fertilizer.

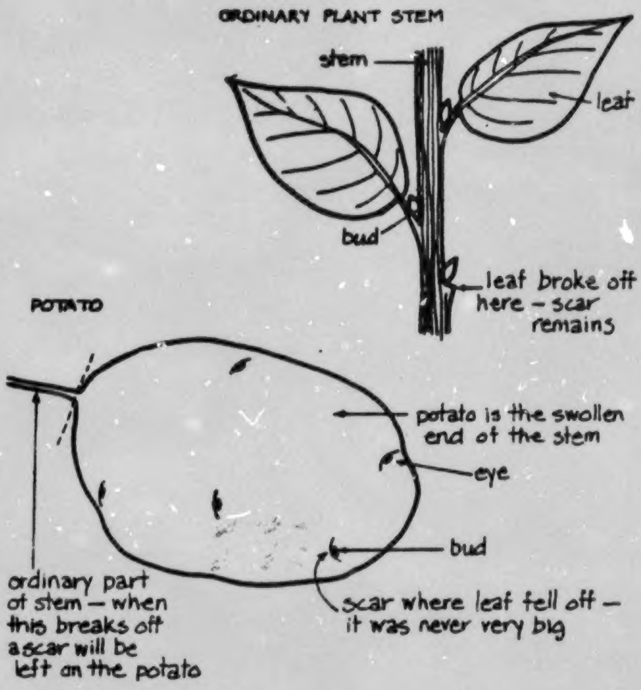
Answers to Questions about rice, page 127.

1. 60
2. Very wet conditions, e.g. a flooded low lying area. Rice also needs hot weather for growth.
3. Land in Zimbabwe is not normally ploughed when it is muddy and flooded. Drier land is easier to plough. (i.e. in winter)
4. Rice is not a main crop here because we do not have many places which are flat, low lying and can be flooded. However, it is possible to grow certain kinds of dryland types of rice.
5. Chopsticks.

Answers to Questions about potatoes, page 127.

1. Potatoes grow well in cold climates. Europe and Russia have cold climates, so potatoes are a successful crop in these areas.
2. A potato is part of a stem.
3. There is more energy-giving food than body-building food in a potato.
4. 70-80% of a potato consists of water.
5. To grow a potato plant you would plant a potato (or half of a potato). The new potato grows from the bud or 'eye' on a potato.

3. **Examining potatoes and rice.**
If possible, bring a potato or two and a few teaspoonsful of rice to class. Let your pupils examine the potatoes. Compare a potato to an ordinary plant stem. Show pupils leaves and buds on this and explain that on a potato the leaves have fallen off leaving a scar (pull a leaf off an ordinary stem and show how a scar would be left.) The tiny bud between the leaf scar and the stem is all that remains. These are called the 'eyes' on a potato. A potato is really a swollen end of a stem. The unswollen, ordinary part of the stem breaks off when potatoes are 'lifted' out of the ground. This leaves a scar too.


ORDINARY PLANT STEM
stem
leaf
bud
leaf broke off here – scar remains
POTATO
potato is the swollen end of the stem
eye
bud
scar where leaf fell off – it was never very big
ordinary part of stem – when this breaks off a scar will be left on the potato

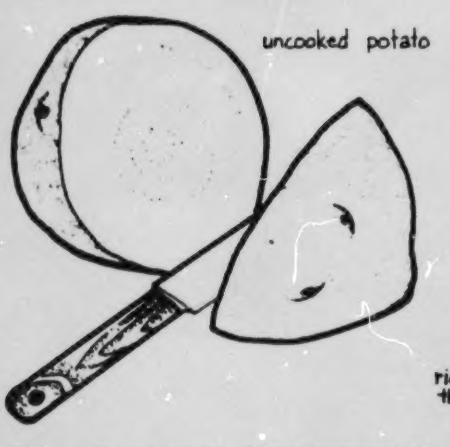
Peel a potato and give pairs of pupils or groups a piece of sliced potato and a few grains of rice to examine.

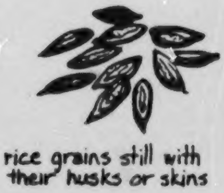
Ask the following questions :
—What colour are these foods?
—Do they have water inside them?
—How hard are they?
—Are they sweet to taste?
—Very little rice is grown in Zimbabwe. Where would rice in the shops come from? (Malawi—or India. It would be *imported.*)

If you have managed to get rice grains let each pupil gently chew one grain. Can they feel a sort of glue-like substance coming out of the rice grain? This is the starch in the grain.

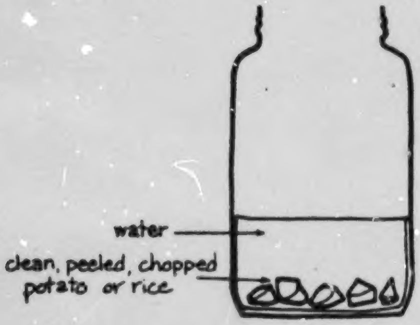
Explain that most rice bought in shops is 'polished' rice. The husk or skin has been removed together with a part of the seed. It is a pity these have been removed as they contain important food.

Compare these to grass seed. Rice is really a grass seed!




rice grains still with their husks or skins

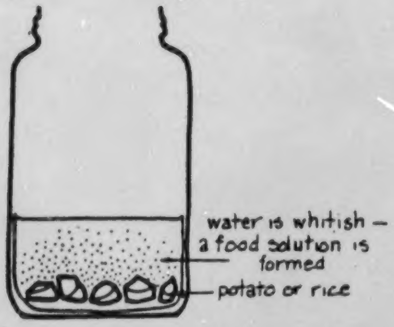
4. Investigating the food inside rice and potatoes
Give each pupil some rice or potato (raw). Tell them to chop up the potato into small pieces. Place them in a jar and cover them with water.



After a few minutes shake the jar. Examine the water above the rice or potato. (Hold to the light.) Is the water clear? What has happened to the water?

A whitish, 'milky' colour is present in the water. Let your pupils dip clean fingers into the water and taste it—compare this to the taste of clean fingers dipped into ordinary water. What has happened?

Help your pupils conclude that something has come out of the rice or potato. Explain that this is *food*. A food solution is being formed.



Let pupils examine a little cooked rice and potato. Mash a little of each up with water. What does it feel like? What is the difference between cooked and raw potato and rice? Why does some food need cooking? Establish that in cooking, water is absorbed by rice. The food becomes soft and slightly glue-like. It is easier for man's stomach to get the food out of the rice or potato, after it has been cooked.

MAIN IDEA: Different staple food crops are grown in different parts of the world

5. Tell pupils to examine the maps on pages 128-131 of the Group Activity Book and to answer the questions. (We suggest pupils use atlases to assist in 'naming' countries).

Answers to Questions

1. India, Japan, S.E. Asia in general.
2. Europe.
3. No, S. America grows more.
4. No, they do not.
5. Europe, United States.
6. Southern Africa, Eastern United States and South America.
7. Wheat and potatoes.
8. Maize.
9. No.
10. The Caribbean, Southern Africa, Brazil.
11. India, W. Africa, China.
12. No.
13. Rice, Groundnuts, Maize and Wheat.
14. No.

6. If you have a large map of the world you may like to connect (by using coloured pieces of wool) pictures or charts showing rice, potatoes, maize and wheat to countries in which they grow.

MAIN IDEA: There is a widening gap between the amount of food grown and the amount of food needed.

7. Tell your pupils to look at the graphs on page 132 of the Group Activity Book. Help them by explaining what these graphs mean. Show them how to use their rulers vertically and then horizontally to find out approximately the amount of food grown and needed in any one year.

Use the graphs for discussion. Would pupils like to ask questions about it?

Answers to Questions

1. No. Not enough food is grown to feed everybody in the world.
2. Yes, the amount of food grown has shown a general increase since 1961.
3. Yes. The prediction is that food grown will increase between 1980 and 1985.
4. Despite a continuing increase in food growth the needs of people increase at a faster rate.

8. Direct your pupils attention to the graphs on page 132 of the Group Activity Book which show population growth in the main areas of the world. Use this for discussion and to explain why the food needs of people are increasing so rapidly. Note these graphs *predict* population sizes in future years. Statisticians use mathematical means based on previous population rates of increase, to work out such graphs. The *curve* of the graph in fact predicts how it will level off in the future.

Answers to Questions

1. Three areas in the world where the population is still growing rapidly at present are South Asia, Africa and South America.
2. Population growth is at present levelling off in East Asia (China), Europe, Russia and North America.
3. The need for more and more food will be greatest in South Asia and Africa.
4. Yes, but it may take a long time before nature has its way.
5. East Asia (China) and South Asia will have the largest populations in the year 2000.
6. South Asia and Africa will have the largest populations in the year 2075.

Background Information for Teachers

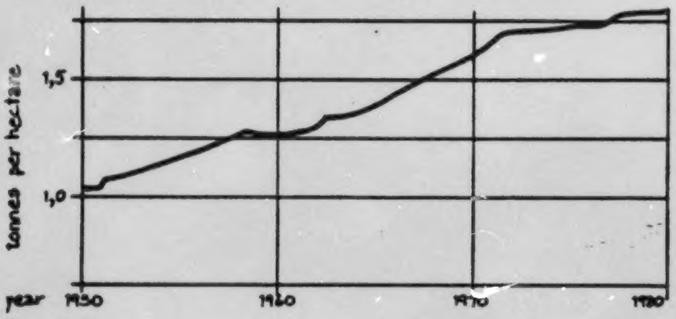
The people of the world need more and more food. How can this be achieved? Two alternatives are available:

(a) to increase food production on the *same* land
(b) to increase the land *area* cultivated

The amount of suitable unused land left on which to grow food is limited. Some uncultivated land may be covered by natural forests. The removal of these is often unwise, leading to severe erosion (e.g. in the Amazon jungle in Brazil; on steep hill slopes). In addition natural forests supply timber and the world is becoming increasingly short of this, too.

Enormous improvements have been made in increasing food production on the same *area* of land, e.g.

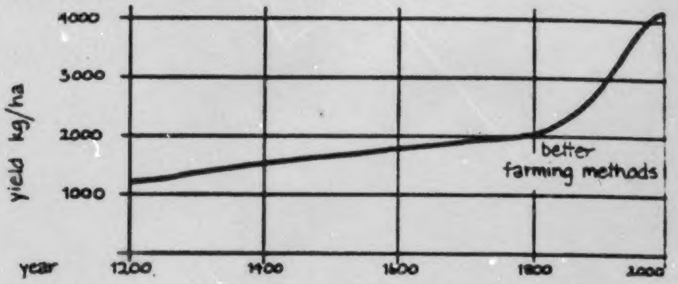
world yield of grain per hectare



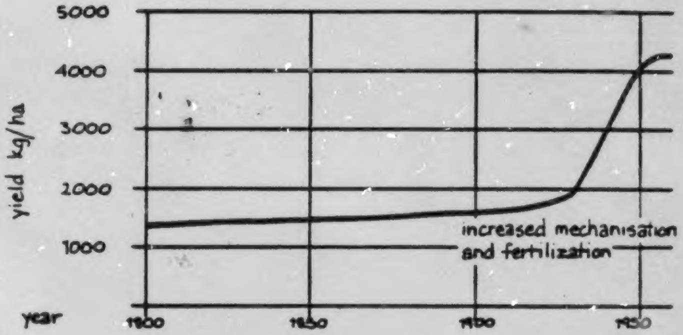
This graph shows that between 1950 and 1977 the amount of grain produced per hectare increased from just over 1 tonne to nearly 1,75 tonnes. These are, of course, average figures for the world. It should also be noted that from 1972 the increase levelled off indicating that there is a limit to how much food can be grown on any one hectare of land even with good management, good seed and fertilizer.

The following two graphs show how yield can improve when modern technology is applied to a crop.

rice in Japan



maize in U.S.A.



However, the 'extra food' that modern technology makes available does little to solve the problem if population growth continues to increase rapidly.

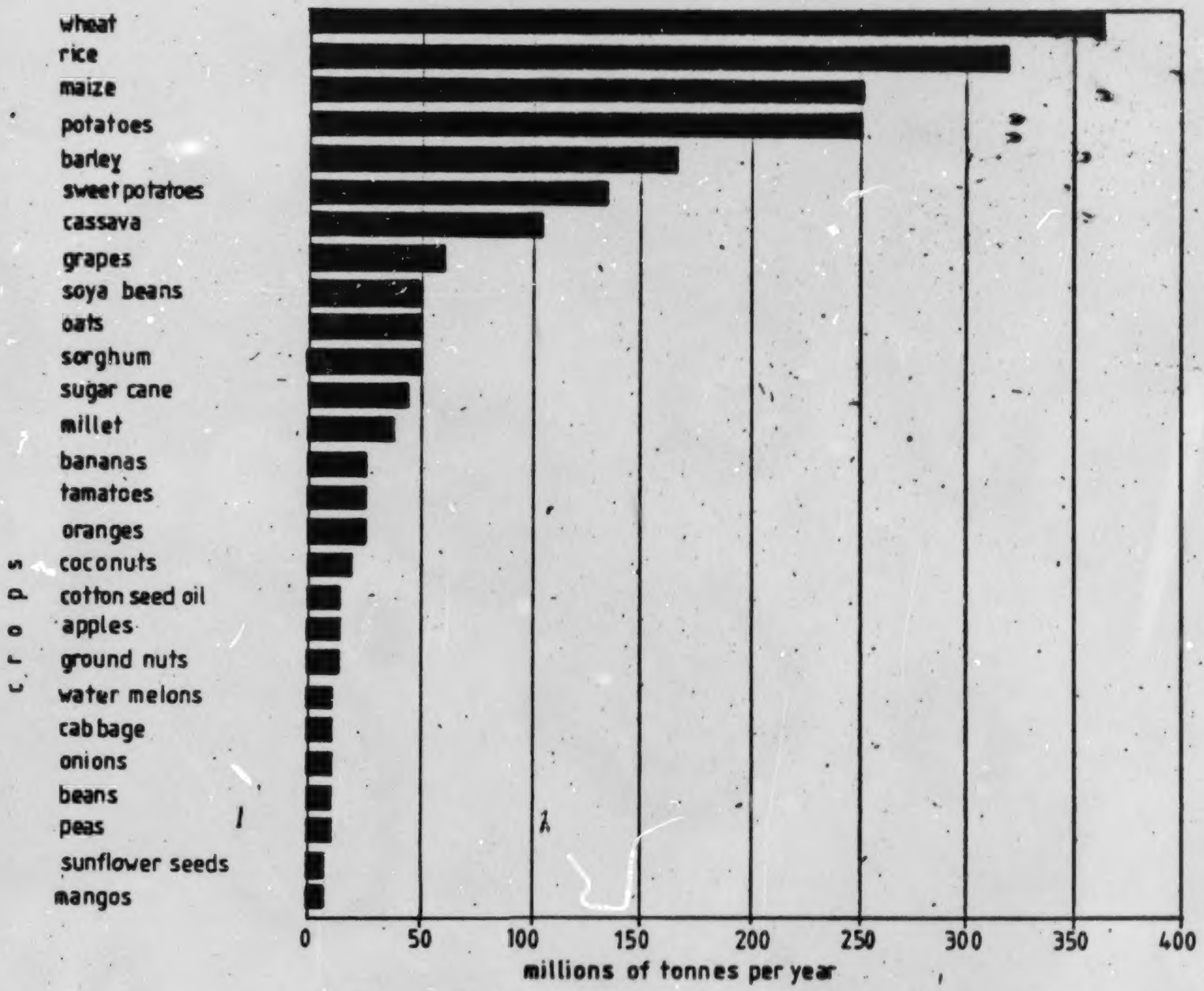
The example of *Mexico (Central America)* is interesting. In 1960 it did not export any food but *was* able to feed its people. From 1960-1970 better seed, more fertilizer and good management were used. In 1970 it was able to feed its people *and* export four million tonnes of food. However, in the meantime, it did nothing to halt its rapidly expanding population. By 1976 all the 'extra' food was needed for feeding its people *and* in addition it had to import three million tonnes of food despite the continuing use of modern technology.

You might like to use this true account with your pupils and ask them what the moral of the story is!

Films: A number of good films on various staple food crops are available from A.V.S.

26 Main food crops of the world

Annual world production of plant foods



Answer these questions

1. Which are the *four* main food crops grown in the world?
2. Make a list of plants from the list given above that you know are grown in Zimbabwe.
3. Does the world produce more groundnuts than bananas?
4. About how many million tonnes of wheat does the world produce in one year?
5. How many million tonnes of soya beans are produced in one year?
6. Is more rice grown in the world than maize?

A world food crop: rice

Rice is the staple food for 60% of mankind.

Rice grows in hot low-lying places such as the flat deltas and flood plains of the great rivers of South East Asia. The crop takes four months to grow and during that time must have a great deal of water.

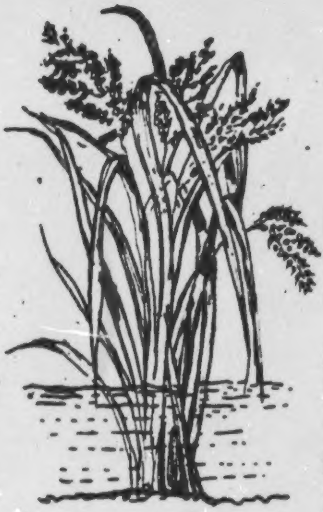
More than half of all cultivated land in Japan is used for growing rice.

In India and South China more than one quarter of cultivated land is used for growing rice.

Rice belongs to the same family or tribe as grass plants. It is really a type of grass.

Rice plants grow in flooded fields.

This Japanese man is ploughing in a very muddy 'paddy' field. Young rice plants are then planted out by hand.

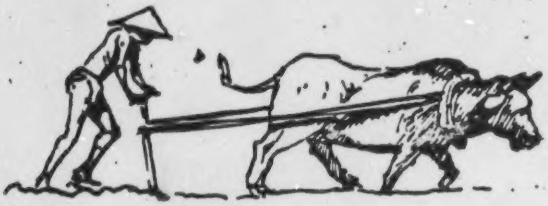


leaves of rice plants have a dark green colour

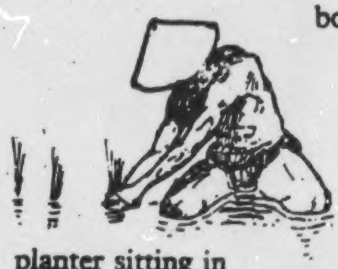
height between 40 — 50 cm

the lower part of the plant is covered by water

A rice plant



water — flooded fields help to slow down the growth of weeds



planter sitting in flooded paddy field

bowl of rice

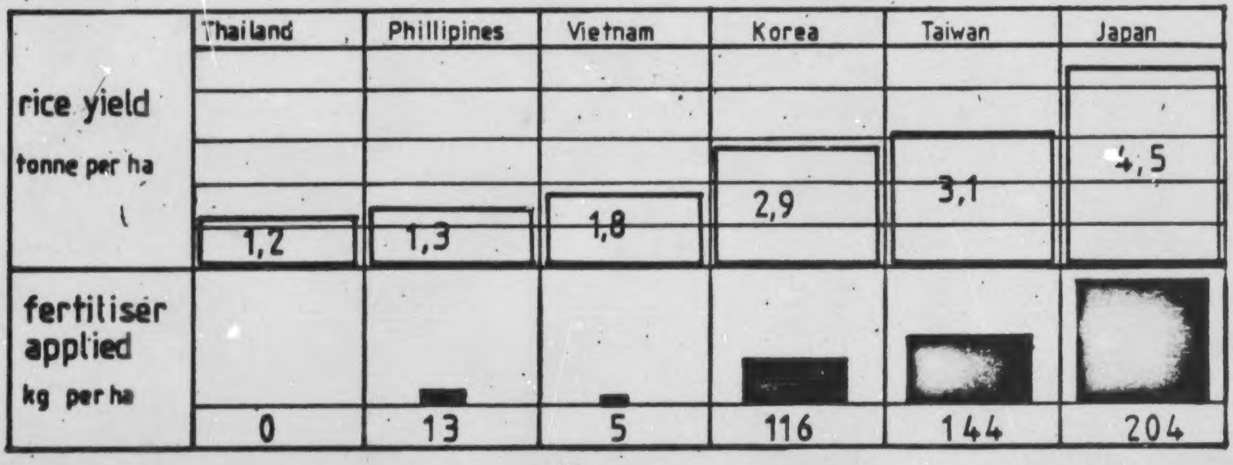
chop sticks

rice is always eaten with chop sticks

How fertiliser affects rice yield

These countries occur in Asia. Find them on the map shown on page 152.

The table shows how much fertiliser was used to grow rice.



	Thailand	Phillipines	Vietnam	Korea	Taiwan	Japan
rice yield tonne per ha	1,2	1,3	1,8	2,9	3,1	4,5
fertiliser applied kg per ha	0	13	5	116	144	204

Answer these questions

1. In which country was most fertiliser applied per hectare?
2. How much fertiliser per hectare was applied to rice fields in Korea?
3. How much fertiliser per hectare was applied to rice fields in Thailand?
4. Which country showed the lowest yield of rice per hectare?
5. Which country showed the highest yield of rice per hectare?
6. What conclusions can be drawn from this table?

Other questions about rice

1. For every 100 people in the world, how many people eat rice as their staple food?
2. What conditions are required for growing rice?
3. Why is it easier to plough land in Zimbabwe than to plough a rice paddy field?
4. Why is rice not a main crop in our country?
5. What do rice eating people use to eat rice with? (Try!)

World food crop: potatoes

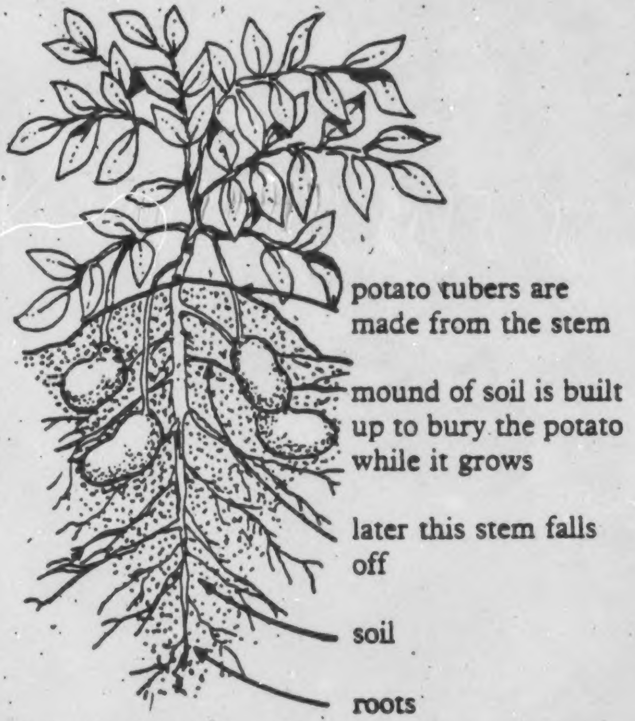
Potato plants grow naturally in South America. Potatoes were brought to Europe by ancient sailors.

The Kings in Europe were so pleased with the new kind of food that they compelled people to grow potatoes (1744 in Germany).

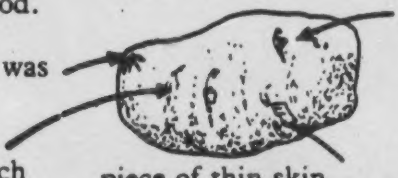
Potatoes grow well in cold climates, e.g. Europe.

It is far too cold to grow maize or rice in Europe and Russia.

In U.S.A. five million tonnes of potatoes are used for making potato chips (sold in packets — potato crisps).


potato tubers are made from the stem
mound of soil is built up to bury the potato while it grows
later this stem falls off
soil
roots

A potato contains: 70 — 80% water; 8% energy giving food; 1 — 4% body building food.


scar where stem was attached
small marks which are really breathing pores
piece of thin skin which is really a kind of leaf

This scar is called an 'eye' of the potato. It is really a bud. If a potato or part of a potato is planted, then a new plant will grow from this bud.

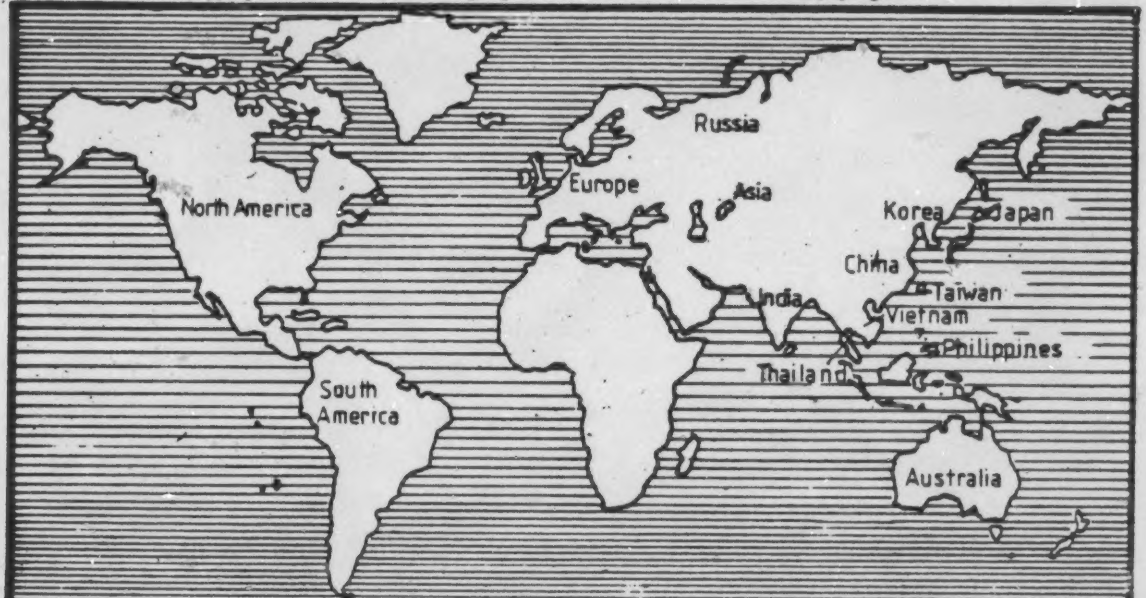
Sometimes you can see these buds starting to grow on a potato. This is called a 'seed' potato. (Not a true seed!)

Answer these questions

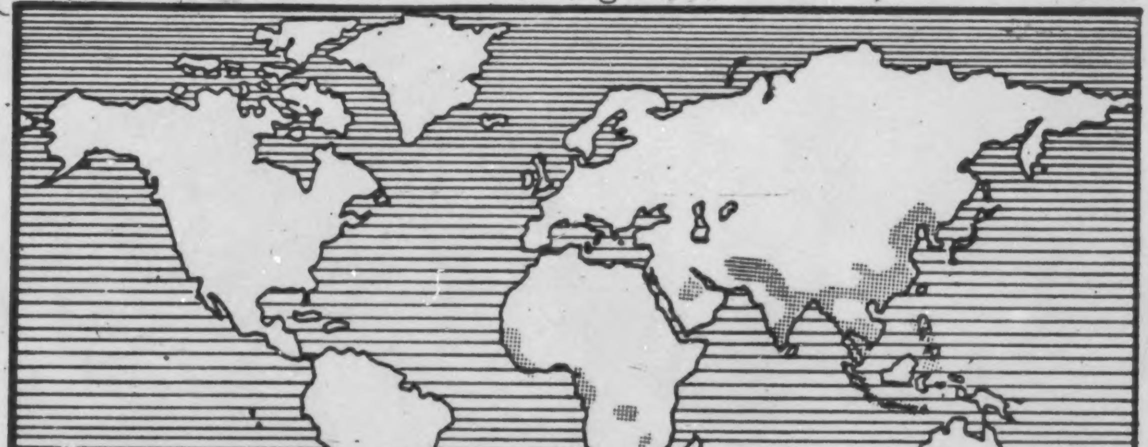
1. Why do potatoes grow well in Europe and Russia?
2. Is a potato part of a stem or part of a root?
3. Is there more energy giving or body-building food in a potato?
4. What percentage (%) of water is present in a potato?
5. If you wanted to grow a potato plant what would you plant?

Where do the food crops of the world grow?

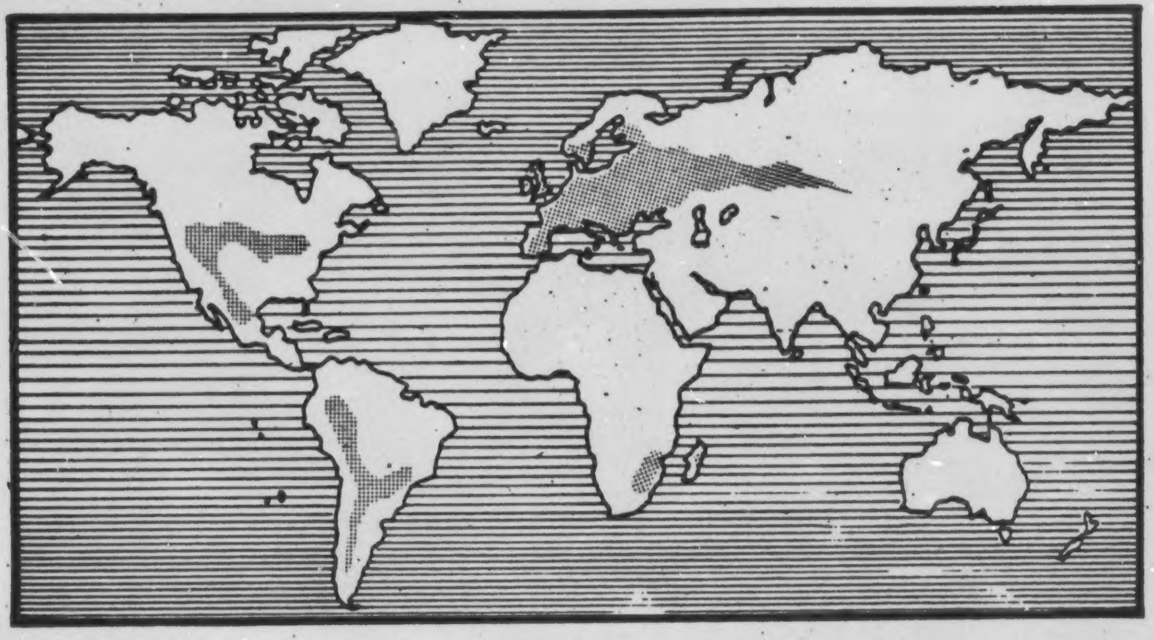
This map shows the names of some continents and countries in the world. Refer to this map when answering questions on the following pages:


Russia
Europe
Asia
North America
Korea
Japan
China
Taiwan
India
Vietnam
Philippines
Thailand
South America
Australia

Areas in the world where rice is grown



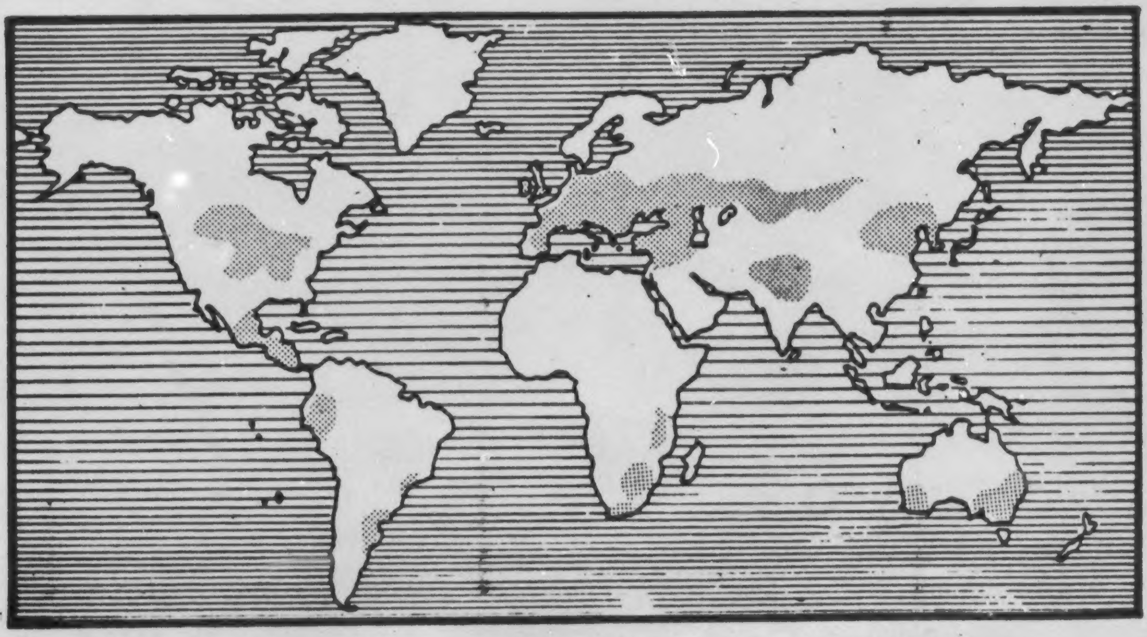
Areas in the world where potatoes are grown



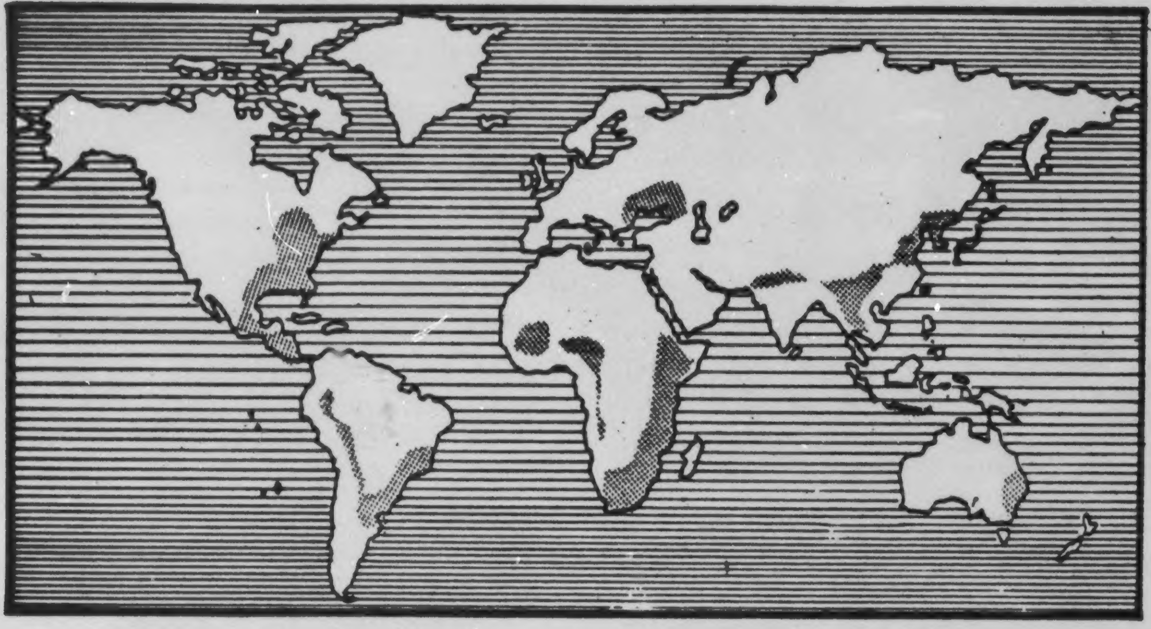
Answer these questions

1. Which are the main *rice* producing areas in the world? (Name three)
2. Which is the main *potato* growing area in the world? (Name one)
3. Are more potatoes grown in southern Africa than in South America?
4. Do rice and potatoes grow in the same areas of the world?

Areas in the world where wheat is grown



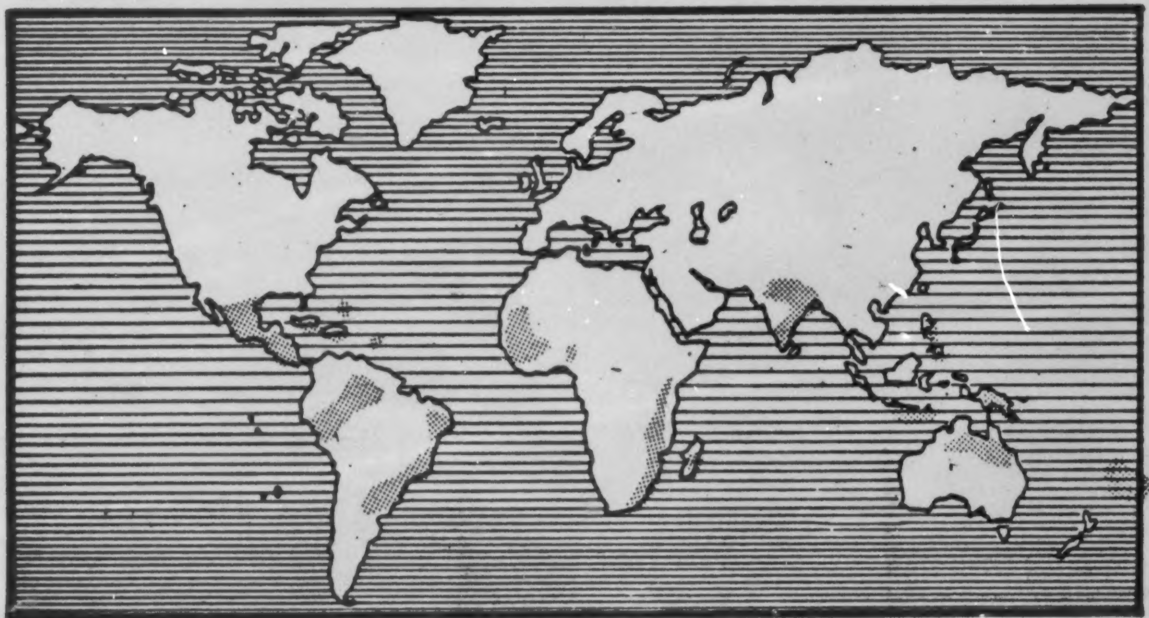
Areas in the world where maize is grown



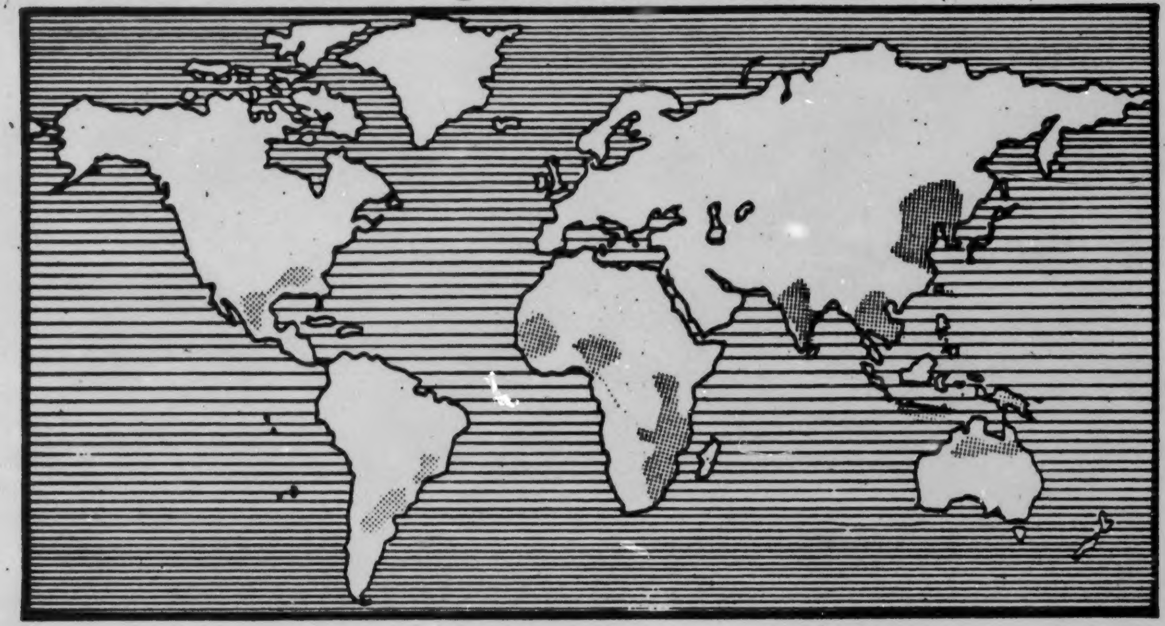
Answer these questions

5. Which are the main *wheat* producing areas in the world? (Name two)
6. Which are the main *maize* producing areas in the world? (Name three)
7. What are the main food crops grown in Europe?
8. Which of the following food crops form the staple (main) food for people living in Africa: rice, potatoes, wheat, maize?

Areas in the world where sugar cane is grown.



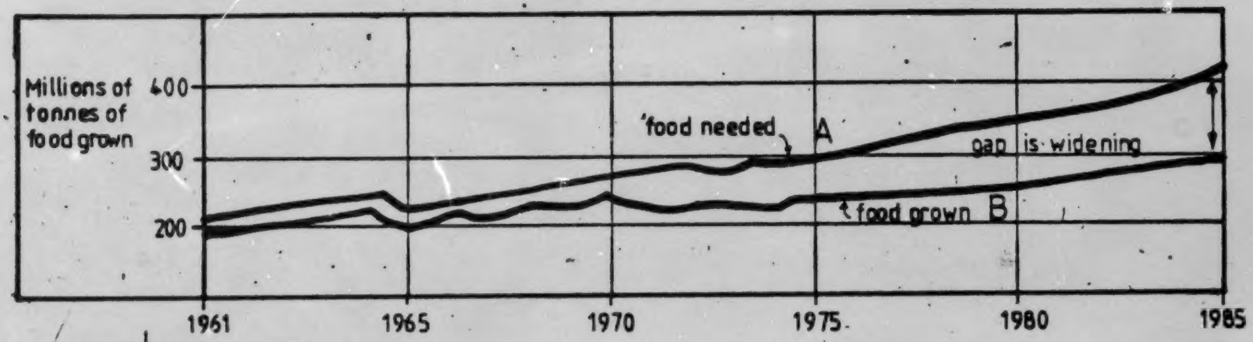
Areas in the world where groundnuts are grown



Answer these questions

9. Is sugar cane grown in China?
10. Which are the main *sugar cane* growing areas in the world? (Name three)
11. Which are the main *groundnut* producing areas in the world? (Name three)
12. Are groundnuts grown in Europe?
13. Name four main crops grown in China.
14. Does the northern part of Africa produce as much food as the southern part of Africa?

Is there enough food in the world?



What do these graphs mean?

Graph A: This shows that the amount of food needed by people for eating is increasing all the time. By 1985 more than 400m tonnes will be needed to feed the people of the world. About 300m tonnes was needed in 1975. So between 1975 and 1985 man needs to increase the food grown by 100 million tonnes.

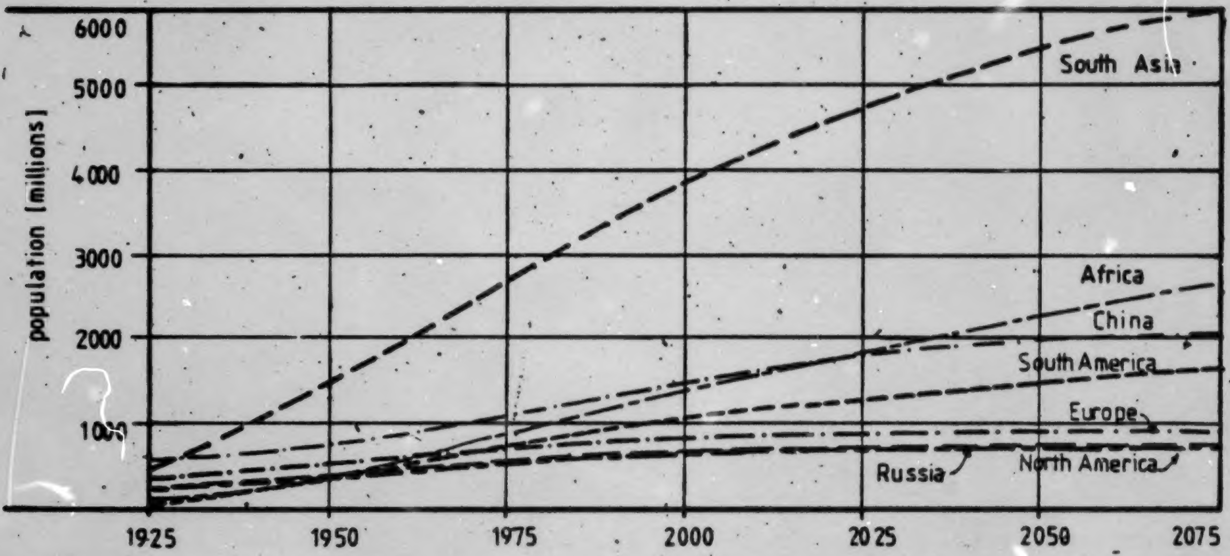
Graph B: This shows how much food has been grown in the world from 1961 till now. It also shows how much food it will be possible to grow in future years.

Answer these questions

1. Is enough food being grown to feed the people of the world?
2. Has the amount of food grown in the world shown an increase from 1961 till now?
3. Will more food be grown in 1985 than in 1980?
4. If more food is being grown every year, why does it never seem to be enough?

Estimated population growth

These graphs explain why it is difficult to supply enough food to feed everyone in the world.



Answer these questions

1. Name three areas in the world where at present the population is still growing rapidly.
2. Name four areas in the world where at present the population growth is starting to slow down and 'level off' or stay the same.
3. In which two areas of the world will the need for more and more food be greatest in future years?
4. How long from now will it take for *all* populations to stop increasing and stay the same?
5. Which two areas in the world will have the largest populations in the year 2000?
6. Which two areas in the world will have the largest populations in the year 2075?

PURPOSE: To show that personal decisions frequently have international implications.

LEVEL: Middle school - Adult

SUBJECT: Social Studies, Science, Math, Home Economics

CONCEPT: Choices made in a school cafeteria usually have an energy impact.

REFERENCE: Developed by: Margaret E. Cowan, Dave M. Deutsch, Barbara Gugerli-Dolder, Christian L. Hanna, Lori D. Mann, Karen A. Rutledge, William B. Stapp, Jane L. Taylor, Deborah S. Yandala, Paul T. Zeph, Karen S. Zimbelman, University of Michigan, School of Natural Resources.

MATERIALS: Magazines, glue, scissors, index cards (5" x 8" and 3" x 5"), Master Chart, Key to Master Chart. For each participant: copy of Master Chart worksheet, pencil.

PREPARATION FOR THE ACTIVITY:

1. Gather magazines containing pictures of common food items. Cut out pictures of each of the 31 food items listed in "Cafeteria Selections" below. Write the name of each of the food items on one of 31 5" x 8" index cards. Glue one or more pictures of the appropriate food item on each card (i.e., on the card labelled "chicken" there would be one or more pictures of prepared chicken).

2. Label each of five tables placed along the walls of the room with one of the following categories: Meats; Dairy; Nuts and Grains; Produce; and Beverages. On each table, place the picture cards belonging to that category. The "Cafeteria Selections" list details the entries in each category; i.e., the "Meats" category includes hamburgers, cold cuts, chicken, chicken soup, steak, and tuna fish.

   In front of each of the picture cards, place a stack of 3" x 5" index cards labelled on one side with the name of the product. On the reverse side, place the Transportation (T), Processing (PR), and Packaging (PA) information that corresponds to that food item. The "Cafeteria Selections" master chart contains the necessary data.

3. Make a Master Chart and Keys to Transportation, Processing, and Packaging Codes identical to those outlined below, leaving out the "Group Totals" column. Keep these sheets covered until debriefing begins.

4. A handout listing all the cafeteria selections that excludes the location, transportation, processing, and packaging data can be given to each participant at the start of the activity to help them plan their meal in advance (optional).

ACTIVITY:

1. The instructor asks all of the participants to select 3-5 food items for a complete lunch from the simulated cafeteria in the room. Students should take one 3" x 5" card from the stack in front of the picture card for each item they select. Allow a specific amount of time to complete the task; 10-15 minutes should be adequate. If students prefer to plan their meal prior to visiting the simulated cafeteria, refer them to the optional list reproduced for each person. Inform the students that questions regarding any items in the cafeteria should be directed to the cafeteria manager (the instructor).

2. After selecting their 3-5 items from the simulated cafeteria, students should return to their chairs to commence the debriefing exercises.

DISCUSSION:

1. Explain that local decisions have international implications. Brainstorm a list of international issues relating to food and ways in which food is an international issue.
   (labor exploitation, land use, pesticides, fertilizers, resource use, global farm issues, hunger, food distribution, political issues, embargos, food as a weapon, economic issues, religious issues).

2. Compile and record food choices made by participants. Distribute a Master Chart worksheet to each participant and tally and record the total number of individuals choosing each food.

3. Reveal the Master Chart and inform participants that blue = low energy use, green = moderate energy use, and red = high energy use. Offer no further explanation.

4. Decoding and Discussion:
   For each category, derive a list of possible factors affecting the amount of energy use inherent in different choices. Evaluate the food choices made by the participants as a group. Be careful not to criticize any individual for the choices he or she has made.

   a. Transportation factors: distance; type of transportation; refrigeration

   b. Processing factors: cooking; cooling; freezing; dehydrating; freeze drying; canning; fresh--how much processing, what kind of processing, stages of production

c. Packaging factors: type of material; resources used; decay time; scale; quantity of material; unnecessary wrapping; sources (location) of packaging materials

5. Expose the key used to determine the point values and briefly discuss how it relates to food choices. It should be made clear that these codes are not absolutes; rather they provide a general estimate of the energy involved within each of the categories (transporting foods, processing foods, and packaging foods). The codes are not transferable; the colors used on the energy scale within one category are not meant to correspond to the energy used in other categories. For example, blue in the transportation code does not equate to the blue in the packaging code.

6. Have each participant list personal changes that could be made to decrease energy consumption in the choices made during the first step of the activity. Stress the wide range of possibilities, and encourage participants to look beyond the most obvious choices.

7. Share the lists of possible energy-saving actions among all participants.

ADDITIONAL DISCUSSION QUESTIONS:

1. Did you (or do you think people in general) ask the cafeteria manager (instructor) any questions relating to the food items (such as where a product was grown or shipped from; how the product was processed; whether any of the products were locally grown; whether fertilizers or pesticides were used in the production of a food item, etc.)?

2. Did you (or do you think people in general) give any consideration when you went through the cafeteria line to the buying of foods grown locally or regionally over a same product grown more distantly?

3. When you went through the cafeteria line, did you (or do you think people in general) give much consideration to how the food items you chose were processed (fresh, canned, frozen, or dehydrated)?

4. When you went through the cafeteria line, did you (or do you think people in general) give much consideration to how the food items you chose were packaged (paper, metal, glass, plastic)?

5. How might the amount of energy we use in our food choices affect the rest of the world?

6. Did you learn anything new from this activity? Did anything surprise you? Will this activity have any impact the next time you go through the cafeteria line? If so, what kinds of impact? How might you change your food choices to use less energy? How do these ideas relate to your family and the foods you eat at home?

7. In addition to individual actions, what actions can be taken as a class? As a family? As a community?

8. What are the relations between saving energy in our food choices and protecting the global environment?

MASTER CHART: CAFETERIA SELECTIONS
WORKSHEET

GROUP TOTAL	FOOD ITEM	SOURCE	TRANSPORTATION	PROCESSING	PACKAGING
	MEATS				
____	Hamburgers	Australia	red	green	red
____	Cold cuts	various	green	red	red
____	Chicken	California	green	green	red
____	Chicken soup	various	green	red	blue
____	Steak	Texas	green	green	red
____	Tuna fish	Pacific	red	green	green
	DAIRY				
____	Eggs	Michigan	blue	green	red
____	Cottage cheese	Michigan	blue	green	red
____	Yogurt	Ohio	blue	green	blue
____	American cheese slices	various	green	red	red
____	Swiss or cheddar cheese	Midwest	blue	green	red
____	Ice cream	various	green	red	blue
	NUTS AND GRAINS				
____	Whole wheat bread	various	green	blue	red
____	Convenience rolls	various	green	green	red
____	Minute rice	various	green	red	blue
____	Peanut butter	various	green	blue	green
____	Mix cake	various	green	red	blue

MASTER CHART, continued

GROUP TOTAL	FOOD ITEM	SOURCE	TRANSPORTATION	PROCESSING	PACKAGING
	PRODUCE				
____	Banana	Latin America	red	blue	blue
____	Apple	Michigan	blue	blue	blue
____	Orange	California	green	blue	blue
____	Canned pineapple	Hawaii	red	green	green
____	Mashed potatoes	Idaho	green	red	blue
____	Tomatoes	Mexico	red	blue	blue
____	Carrots	Michigan	blue	blue	blue
____	Canned peas	various	green	green	green
____	Frozen spinach	various	green	red	blue
	BEVERAGES				
____	Tea	Sri Lanka	red	green	blue
____	Coffee	Brazil	red	red	green
____	Juice (frozen)	Florida	green	red	green
____	Milk	Michigan	blue	green	green
____	Soft Drink	various	green	red	red

KEYS TO COLOR CODES

CATEGORY	BLUE	GREEN	RED
Transportation	local or regional	national	international
Processing	low (fresh)	moderate (refrigerated, canned)	high (frozen or dehydrated)
Packaging	low (paper)	moderate (glass or metal)	high (plastic, stryofoam, aluminum)

PURPOSE: To examine the potential of "fish gardening" as a recycling process.

LEVEL: Junior-senior high school

SUBJECT: Science, Social Studies

CONCEPT: Social values and mores influence personal conservation behavior.

REFERENCE: Bowman and Coon, 1978, p. 98.

Fish farming has been used as a source of high-quality protein in China for centuries. Near a Chinese home may be located a small pond situated so that it receives water run-off from the family pig-sty. The fertilizer draining into the pond encourages the growth of small organisms in the pond. The organisms start a food chain that results in substantial production of edible fish.

The Chinese, with enormous pressure to produce food for their population of 800,000,000 people, have developed the science of fish farming to a very high level. They will, for example, put into a pond with a depth of 8-10 feet several varieties of fish that live at various depths; grass-eating carp will be found on the top, plankton-eating carp in the middle, and bottom-feeding carp below. In this arrangement each lower species benefits from (recycles) the waste products of the one above.

Many persons are unaware of the efficiency of fish as protein producers. Since things weigh less in water than they do in air, fish use very little energy to support themselves, in contrast to beef animals who use considerable energy simply to stand. Secondly, since fish are cold-blooded and simply change their temperature to match that of the water they are in, fish use no energy to keep warm in the winter or cool in summer.

Simply put, a ton of fish food put into a properly-designed fish pond will produce substantially more protein than a ton of cattle food will produce in a well-designed beef feedlot. And the fish food can consist, in part, of food scraps and other waste materials.

ACTIVITY:

Involve the class in examining the practicality of fish gardening in the United States. Under what circumstances is a relatively small fish garden or pond practical? Are farm ponds frequently found along interstate highway construction used as fish farms? If so, what can be done to increase their productivity?

Suggest that students contact leaders of local sportsmen's clubs, well-known fishermen, appropriate personnel in State Departments of Natural Resources, or university specialists in ichthyology to get background information prior to a class discussion on the topic.

DISCUSSION:

1. How does fish farming compare to raising beef cattle? Consider land use and energy implications.
2. How might the United States benefit from China's experience with fish farming?
3. What impacts might a shift in diet from beef to fish consumption have on the world environment? Would such a shift be of benefit?
4. What can individuals do to help bring about such a shift in diet?

PURPOSE: To consider moral issues involved in providing food to starving populations.

LEVEL: Senior high school

SUBJECT: Social Studies

CONCEPT: Struggles of many families and nations to develop economically are prolonged and made more difficult by rapid population growth.

CONCEPT: Schultz and Coon, 1977, p. 162.

ACTIVITY:

Review with the class the historical fact that famine was, in earlier times, an effective population control mechanism. Prior to the development of modern communication and transportation systems, millions of persons died from starvation in countries such as China and India without receiving substantial help from other countries.

Today through the help of agencies such as the United Nations, the United States Agency for International Development, and religious groups, food is quickly sent to areas where starvation threatens. Children who in earlier times would have starved to death are kept alive. Subsequently they marry, have children, and add to the population explosion.

Some persons have argued that the United States government should not send food to any country unable to feed itself unless that country undertakes serious measures to limit its population growth.

Engage the class in discussing the two sides of this position. As a part of the discussion invite religious leaders (priest, minister, rabbi) and, if possible, a spokesperson from the United Nations to come into the classroom to present their ideas on this subject.

PURPOSE: To demonstrate to students the fact that seven pounds of grain are needed to produce one pound of beef.

LEVEL: Senior high

SUBJECT: Mathematics, Social Studies

CONCEPT: Beef consumption has a strong impact on global issues such as hunger.

REFERENCE: Victor and Kraft, 1976, pp. 31-33.

(A similar activity was developed by Donald Morris for UNICEF titled "Teaching About World Hunger"; the unit is available from UNICEF, 331 East 38th Street, New York, N.Y. 10016.)

MATERIALS: 1 pkg. of crackers per student.

ACTIVITY:

Pass out a package of crackers to each student in the class. As you are doing this, ask how many would rather have a piece of meat (beef). Have them raise their hands if they would rather have beef. Count the number of students who would rather have beef.

1. If the number who want beef is greater than one-seventh of the class (4 of 28, 5 of 35, etc.):

    a. Collect all the crackers that were distributed.

    b. Next, distribute pieces of beef to the first 4, 5, or 6 students (whichever number comes closest represents one-seventh of the class) requesting it.

    c. At this point, some students might inquire why only certain individuals received beef. Others might be concerned as to why they had to give up their crackers and are now left with nothing.

    d. At this time, the teacher can have students speculate why the above occurred. After some discussion, it might be related to them (if necessary) that if they were eating grain (crackers) the entire class could have been fed. But, some of the class members wanted beef. Therefore, in order to have beef, others had to give up their grain. In order for some to have beef, others cannot eat.

2. If less than one-seventh of the class wants beef:

    a. For each person who wants beef, take packages of crackers away from seven students. For example, if two students want beef, take the crackers away from the nearest fourteen students.

b. Students might make inquiries similar to those in c. above. The teachers should follow a strategy similar to the one outlined in d. above.

This discussion can be furthered by telling students that twenty years ago the average American ate 50 pounds of beef annually. This year each will eat 120 pounds--almost 2½ times as much. From this you might then discuss:

--Whether they feel it is right for people in this country to consume such large quantities of beef while others are starving. (Consider underdeveloped countries as well as impoverished areas of this country.)

--What can we and other developed nations do? Should we just give grain to these people? Should we give them beef?

--What benefits would we receive if we gave away our grain? Why should we reduce our beef consumption? (Should a person concerned about global problems consider these types of questions?)

While it is true that it takes seven pounds of grain to produce a pound of beef, it does not necessarily follow that all the gains in weight that a steer makes are the result of being fed grain. The beef growers associations are responding to criticisms that Americans eat too much beef by saying that the bulk of a steer's weight comes from grazing on pasture land which is too dry to produce grain, and that not to raise cattle on such land means that it simply will go to waste. If the teacher elects to invest time in analyzing this argument, the students could interview farmers in their region who raise beef cattle. Some suggested questions which might be asked are:

1. Do you raise most of your beef cattle from calves or do you buy feeder steers and fatten them for market? If so, from what part of the country do you get the feeder steers?

2. What do you feed the steers you raise (or fatten)?

3. How do you feel about grass-fed rather than grain-fed beef; i.e., do you think Americans would learn to like the former?

4. If Americans were to reduce their meat consumption by 50% what would you do with the grain, pasture, and other resources which you now devote to the production of meat?

5. Is the land which you now devote to pasture capable of growing grains such as wheat, corn, or soybeans?

6. As a farmer, how do you feel about the contention that Americans ought to produce less meat for consumption in the developed nations and in its place produce grain for the people of the less developed nations? As long as you could be assured of a ready market for your products do you care whether you raise meat animals or grain?

The above discussion would proved to be a useful vehicle for a student presentation of their values on this particular issue. At different points throughout the year, such discussions could be held to determine their "global ethic" development.

Additional statistical representations which could be used are:

1. In underdeveloped countries, 25 to 30 percent of the children die before the age of four.
2. In rural India, 30% of the preschool children suffer from "dwarfism" or stunted growth.
3. Asia, without the U.S.S.R., contains over one-half of the world's population. This percentage will continue to grow in the future.
4. Annually, the United States, which has 6% of the world's population, consumes 34% of the world's energy.
5. The threat of severe malnutrition or even starvation faces 400 to 500 million children in the world's poorer countries. Presently, that represents about one-tenth to one-eighth of the world's population.

PURPOSE: To examine possible solutions to the dilemmas surrounding coffee production and consumption.

LEVEL: Senior high.

SUBJECT: Social Studies.

CONCEPT: Various solutions to the problems posed by worldwide coffee demand affect different groups of people.

REFERENCE: Victor and Kraft, 1976, pp. 34-36.

MATERIALS: Handout (Coffee Dilemma).

ACTIVITY:

1. Ask the students to read the article about coffee and define the problem. They should include the following points:
   - a. More coffee is being consumed than is now produced.
   - b. When Brazilian farmers take more land to grow coffee fewer other types of food are produced.
   - c. The money Brazil makes from coffee does not buy enough food for that country. It is used to buy energy.
   - d. The U.S. makes the greatest demand on the limited supply of coffee.

DISCUSSION:

1. After students have defined the problem, ask them individually or in groups to develop a solution to ease the coffee dilemma. In their solutions they must indicate how the following people would be affected: American coffee drinkers, Brazilian coffee farmers, Brazilian farm workers, the Brazilian government, and coffee drinkers around the world.
2. In what ways can individuals contribute to the solution of the coffee dilemma?

Coffee Dilemma*

The rise in coffee prices from 85 cents to $2.25 for a pound of green (unroasted) beans is just one more signal of a serious food problem facing the world, according to commodity specialists.

Coffee exports have been exceeding production by at least 5% a year for more than the last 10 years. In 1974 (the last full year before the Brazilian frost) world green coffee bean output was about 55 million bags at 132.2 lbs. each. Official import totals for coffee reaching the world's coffee-consuming nations were 56 million bags, plus 5 to 7 million bags to "tourist" (smuggled) coffee. The difference came from stockpiled beans that had accumulated in private and state-owned warehouses over the years.

The use of coffee is increasing in many parts of the world. Japan in 1972 did not import enough coffee to even bother to keep statistics. In 1976, Japan imported 3 million bags of coffee, or 6% of the world exports. The demand for coffee has increased in many nations where it was once considered a luxury item. Between 1963 and 1974 Europe raised its coffee imports from 20 million to 30 million bags a year. This, despite the fact that with a heavy tax, ground beans sold for $5.00 a pound during that time. The Soviet Union has become a major importer of coffee. The consumption of coffee also rose in coffee producing nations.

With increasing demand for coffee and the Brazilian frost, along with problems in Angola and Uganda decreasing their production, exports of coffee are down. It is estimated Brazil will export a third of its normal 20 million bags this season. This will cause prices to stay high. If coffee prices stay high, farmers will switch from growing soybeans and corn to growing coffee. If Brazilian farmers do switch this will tend to drive up grain and soybean prices and thus make beef, pork and poultry more expensive for consumers. When Brazilian farmers switched to a cash crop such as coffee, less land was available to grow other types of food. For example, in the last year there has been a shortage of black beans, the staple of the Brazilian diet. The cash crop money tends to go for the purchase of oil for industrial development. Oil prices are rising steadily.

Coffee is a major commodity in world trade. It is second (a distant second) to oil in international commodity dealings. In the U.S. last year, $8.00 per person was spent on coffee and coffee consumption was 12 pounds of coffee per person. By comparison the consumption of coffee per person in the rest of the world was 1.65 pounds per person. More than half of the world's coffee beans were brewed in the U.S.

If worldwide consumption rose to 3 pounds per person (¼th of U.S. consumption), the producing nations could not supply the markets and feed themselves. Land growing coffee is not growing food. "The incredible rises in coffee and cocoa prices are merely another way of telling us that the 4 billion souls on this planet must compete for a steadily shrinking supply of farm produce. Hardly any productive cropland is idle anywhere and increases in one crop must be at the expense of another. The elasticity of supply is gone."

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*Information is from The New York Times, Sunday, January 16, 1977.

PURPOSE: To use one case study to demonstrate that food choices have global implications.

LEVEL: Senior high - Adult.

SUBJECT: Social Studies.

CONCEPTS: The choices that individuals make regarding food purchases have international implications. Multinational agricultural corporations have an effect on people the world over.

REFERENCE: Developed by: Susan Bradford, Norton Fogel, Larry Graff, Dave Herberholz, Lori Mann, Kathleen Standen, Paul Zeph, University of Michigan, School of Natural Resources.

MATERIALS: Information sheets, Newsprint, Markers.

ACTIVITY:

1. Explain to the students that they will be simulating an international inquiry based on an actual study.

2. Divide students into five groups with the following roles:

   . Del Monte Corporate Executives
   . Local Mexican Farmers
   . Mexican Government Officials
   . Environmentalists
   . International Board of Inquiry

3. Distribute information sheets to each group (one per student). If possible, allow an out-of-class session and ask participants to research their role in full: i.e., policies of the Mexican Government regarding the Green Revolution, the educational level, degree of organization, and social structure of the Mexican farmers, etc.

4. Explain to each group that they have 20 minutes to develop a five minute presentation to the International Agricultural Board of Inquiry regarding the agricultural situation in Mexico. The presentation should reflect the attitude that people in each role would most likely have, and also include their suggestions for government action. Each group may want to include alternative measures they might take should their demands not be met. During this time, the members of the International Board prepare for the hearing.

5. After twenty minutes, bring the entire group together in town meeting fashion with the Board of Inquiry facing the remainder of the group. Have a representative from each role group present its five-minute argument.

6. After all presentations have been made, the Board meets for 10 minutes and formulates a list of recommendations for action by the Mexican government regarding the situation.

7. While the board is deliberating, the groups may question one another, discuss, debate, in reference to the presentations.

8. Reconvene the group and allow the board to present its recommendations. This ends the simulation.

9. Discussion and debriefing.

DISCUSSION QUESTIONS:

1. Do you personally (not role playing) agree with the recommendations that the Board of Inquiry made to the Mexican government? Why or why not?

2. What actions can you take to minimize the ill effects of multinational agricultural activities?

3. What might be the international implications of choices you make regarding food purchases at the supermarket?

FURTHER REFERENCES:

1. Frances Moore Lappe and Joseph Collins.
Food First: Beyond the Myth of Scarcity.
Houghton Mifflin Co., Boston. 1977.

2. "Still Hungry After All These Years" (The not so grand opening of the global supermarket). Joseph Collins and Frances Moore Lappe. Mother Jones, August 1977.

LOCAL MEXICAN FARMERS

INFORMATION SHEET

The global demand for certain luxury food products has led many American-based corporations to seek farmland in areas of the world with extended growing seasons. Many of these areas are located in developing countries. In these regions, corporations can produce large quantities of specialty crops in order to export them to people in developed nations who desire the products. Foreign governments often encourage the presence of multinational agricultural corporations because they increase the country's revenues and thus support efforts in industrialization. In addition, corporations benefit from moving to foreign countries where labor and land expenses are lower than in the United States, and profits are thereby increased.

Some multinational corporations have used modern farming techniques without due regard for care of the land. Often times, land productivity is reduced by poor farming practices until the corporation moves on to other sites, leaving behind only depleted soil that is virtually useless for farming.

The Del Monte Corporation, in cooperation with the Mexican government, has contracted rich fertile land in northwestern Mexico to grow asparagus, 90% of which is exported to industrialized western nations. This land previously had been used by local farmers to grow a dozen food crops essential to the Mexican diet, including corn, wheat, and sunflower seeds.

Because of rising land prices, local farmers have been forced to move to marginal lands where it is more difficult for them to raise enough food to meet local needs. Prices of many foods are being forced up because of the alternation of the land system; even beans, Mexico's main staple source of protein, are too expensive for the poor to purchase. In spite of increasing food production in Mexico, hunger is prevalent among much of the nation's populace.

Through the help of a national activist group, an international inquiry into the Mexican situation has been called. A panel of experts will be hearing arguments from all interested parties and formulating a list of recommendations for action by the Mexican government. As local Mexican farmers, prepare a five-minute statement to be presented to this panel. The presentation should reflect the attitudes that you have about the situation, as well as suggestions for government action.

EXECUTIVES FROM THE
DEL MONTE CORPORATION

INFORMATION SHEET

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INFORMATION SHEET

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Through the help of a national activist group, an international inquiry into the Mexican situation has been called. A panel of experts will be hearing arguments from all interested parties and formulating a list of recommendations for action by the Mexican government. As officials of the government, prepare a five-minute statement to be presented to this panel. The presentation should reflect the attitudes that you have about the situation, as well as suggestions for government action.

INFORMATION SHEET

The global demand for certain luxury food products has led many American-based corporations to seek farmland in areas of the world with extended growing seasons. Many of these areas are located in developing countries. In these regions, corporations can produce large quantities of specialty crops in order to export them to people in developed nations who desire the products. Foreign governments often encourage the presence of multinational agricultural corporations because they increase the country's revenues and thus support efforts in industrialization. In addition, corporations benefit from moving to foreign countries where labor and land expenses are lower than in the United States, and profits are thereby increased.

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Through the help of a national activist group, an international inquiry into the Mexican situation has been called. A panel of experts will be hearing arguments from all interested parties and formulating a list of recommendations for action by the Mexican government. As environmentalists, prepare a five-minute statement to be presented to this panel. The presentation should reflect the attitudes that you have about the situation, as well as suggestions for government action.

INFORMATION SHEET

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Through the help of a national activist group, an international inquiry into the Mexican situation has been called. Your group represents a panel of experts that will be hearing arguments from four different viewpoints (executives from the Del Monte Corporation, local Mexican farmers, environmentalists, and officials of the Mexican government). You will then meet for ten minutes to formulate a list of recommendations for action by the Mexican government that will be presented to all in attendance at the hearing.

You have twenty minutes to prepare for the inquiry. In this time, you need to choose names and positions of people likely to be sitting on such an international board of inquiry, select a chairperson to facilitate the hearing, and formulate an agenda for the meeting. You will also need to set up a head table and chairs. The chairperson is responsible for calling the inquiry to order and for introducing the members of the panel.

ENERGY

PURPOSE: To help students realize how events in other parts of the world can affect the United States.

LEVEL: Upper elementary.

SUBJECT: Social Studies, Mathematics.

CONCEPTS: There is a strong relationship between the U.S.A. and oil-exporting countries. The United States imports almost one-half of the oil it needs.

REFERENCE: Johnson and Benegar, 1981, p. 31, plus handouts.

MATERIALS:

Part 1: "Ambassador Cards" (Handout A), large world map, thumbtacks or pushpins, scissors, colored yarn or string, world almanacs or atlases, coffee can or other container.

Part 2: "Sources of Petroleum Imports" (Handout B); large (2-gallon or larger) glass fishbowl or punch bowl, three 3-lb. bags of dried white or pinto beans, three 3-lb. bags of dried red or kidney beans, two large pots or other containers capable of holding three pounds of beans, two styrofoam or paper cups, plastic wrap, world almanacs or atlases.

PREPARATION FOR THE ACTIVITY:

Part 1: cut apart the "Ambassador Cards" (Handout A).

Part 2: purchase the dried beans and assemble the necessary containers described in the "Materials Needed" section.

ACTIVITY:

Part 1

1. Ask students whether they think that oil is an important commodity. Why do we need oil? What are its most important uses? (Accept all answers, but make sure that students mention heat and transportation.)

2. Point out that the United States uses much more oil than it can produce. How do we get the rest of the oil that we need? Make sure that students understand the term and concept "import"--to buy from other countries.

3. Explain that the balance of the activity will be devoted to making an oil import map. Ask each student to draw an "ambassador card" from a coffee can or other container and print his or her name on the card. (Each card

represents a country or group of countries from which the United States imports oil.) Each student should locate his or her country on the large world map (using an atlas or almanac if assistance is needed), determine what length of yarn or string is needed to link that country with the United States on the map, cut off the necessary length of yarn or string, and affix the two ends of the yarn or string to the world map with thumbtacks or pushpins. Allow about 20 minutes for the students to perform these tasks, providing assistance if necessary. Tell them to save their "ambassador cards" for the next part of the lesson.

4. After students have completed the map, ask them to return to their seats and take a good look at it. What part of the world has the most connections with the United States? (You may need to introduce the term "Middle East.") Ask whether students think that the Middle East is important to us. Why? Do students know anything about what is going on in the Middle East? (There are sure to be some important conflicts or negotiations occurring at the moment.) Why might the United States be concerned about current happenings in the Middle East? (Accept all answers.)

DISCUSSION--PART 1

1. Ask each "ambassador" to look for a newspaper or magazine article that tells something about his or her country and use it as the basis for a brief oral report to the class. (Note: Since some students' countries or regions are much more widely publicized than others, allow at least a week for everyone to find an article. Some students may need to use encyclopedias or other library resources.)

2. Ask each "ambassador" to find or draw a picture representing his or her country or region, and use these to make a collage or bulletin-board display.

ACTIVITY:

Part 2

1. Remind the students that not all of the oil used by people in the United States is imported from other countries; the United States does produce much of its own oil. Explain that the oil produced by a country for its own needs is called "domestic" oil.

2. Write the following information on the chalkboard:

domestic oil = 8,500 thousands of barrels per day
(8½ million barrels)

imported oil = 6,643 thousands of barrels per day
(more than 6½ million barrels)

total oil = 15,143 thousands of barrels per day
(more than 15 million barrels)

Explain that these numbers show how much oil the United States uses every day and how much of it comes from each source. (Help the students read and understand the numbers, if necessary.)

3. Arrange the beans and fishbowl or punch bowl on a table in the front of the classroom. Ask if anyone has an idea about how the beans could be used to show how much oil per day the United States gets from each source. (Students probably will realize that the two kinds of beans could represent the two kinds of sources, but they may need some help deciding that each bean will need to represent a large number of barrels. In this activity, each bean must represent 1,000 barrels.) Let students decide which kind of bean should represent which oil source.

4. Let's assume that domestic oil will be represented by white or pinto beans. Appoint one student to count out 100 white beans and put them in a styrofoam or paper cup. Mark the cup to indicate the "fill" level of 100 beans. (Note: This activity is much easier if the empty portion of the cup is actually trimmed away.) Appoint another student to perform the same task with the red beans.

5. Remind the class that each bean stands for 1,000 barrels of oil, and that there are 100 white beans in the cup. How many cups of 100 white beans will be needed to represent U.S. daily consumption of domestic oil? (Depending on students' level of arithmetic reasoning, you may need to explain that the cup will need to be filled 85 times.) Let students take turns filling the cup up to the mark with white beans and pouring them into the bowl. The rest of the class should count out loud until 85 cups of white beans (100 beans per cup) have been poured into the bowl. When approximately 8,500 white beans have been poured into the bowl, level them off and cover them carefully with plastic wrap.

6. Distribute copies of Handout B. Explain that the same procedure will be followed with the red beans, representing imported oil. Each "ambassador" will measure enough beans for his or her country or region, using the information on the handout as a guide to how many cupfuls will be needed. (Students whose countries or regions fall into the "Others" categories will need to get together in groups and share this task.) For example, the "ambassador" for Indonesia will need to fill his or her cup to the correct level approximately three-and-a-half times, while the Saudi Arabian "ambassador" will need about twelve-and-a-half cupfuls. Continue this process until all the countries or regions that supply oil to the United States have added their red beans to the bowl. (You should end up with slightly more than 66 cups, each containing approximately 100 red beans.)

7. Ask students how much of the oil we use is imported. (In 1981, the amount was slightly less than half, or 45 percent.) Of the imported oil, which countries supply the most? Which "ambassadors" put the most red beans in the bowl?

8. **Write the following equations on the chalkboard:**
   1 barrel = 42 gallons
   4 quarts = 1 gallon
   4 cups = 1 quart

   Ask students to figure out how many cups of oil are in a barrel (672). Ask them to guess how many cups of oil the average person in the United States used per day in 1980 for heating, transportation, and other purposes. Record all guesses on the chalkboard and see who came closest to the right answer (112 cups, or 7 gallons). Is that number hard to believe?

DISCUSSION--PART 2

1. **What effects do personal actions have on the amount of oil imported by the United States?**

2. **Would it be beneficial or harmful to reduce or stop imports?**

3. **In what ways could the U.S. reduce the number of "cups" of oil used per day? What impacts would this have?**

RESOURCE NOTE:

Up-to-date information about U.S. oil consumption, domestic oil production, and petroleum imports is available in Monthly Energy Review, issued by the Energy Information Administration Clearinghouse, U.S. Department of Energy, 1000 Independence Ave., S.W., Washington, D.C. 20585.

Handout A
AMBASSADOR CARDS

This card introduces ____________________ ____________________ Ambassador for Algeria	This card introduces ____________________ ____________________ Ambassador for Indonesia
This card introduces ____________________ ____________________ Ambassador for Iran	This card introduces ____________________ ____________________ Ambassador for Libya
This card introduces ____________________ ____________________ Ambassador for Nigeria	This card introduces ____________________ ____________________ Ambassador for Saudi Arabia

Handout A

This card introduces

____

____

Ambassador for United Arab Emirates

This card introduces

____

____

Ambassador for Venezuela

This card introduces

____

____

Ambassador for Ecuador

This card introduces

____

____

Ambassador for Iraq

This card introduces

____

____

Ambassador for Gabon

This card introduces

____

____

Ambassador for Kuwait

Handout A

This card introduces ______________________ ______________________ Ambassador for Qatar	This card introduces ______________________ ______________________ Ambassador for the Bahamas
This card introduces ______________________ ______________________ Ambassador for Canada	This card introduces ______________________ ______________________ Ambassador for Mexico
This card introduces ______________________ ______________________ Ambassador for Netherlands/ Antilles	This card introduces ______________________ ______________________ Ambassador for Puerto Rico

Handout A

This card introduces ________________________________ ________________________________ Ambassador for Trinidad/Tobago	This card introduces ________________________________ ________________________________ Ambassador for the Virgin Islands
This card introduces ________________________________ ________________________________ Ambassador for Western Europe	This card introduces ________________________________ ________________________________ Ambassador for Angola
This card introduces ________________________________ ________________________________ Ambassador for the USSR (Russia)	This card introduces ________________________________ ________________________________ Ambassador for Rumania

Handout A

This card introduces ______________________________ ______________________________ Ambassador for other Middle East countries	This card introduces ______________________________ ______________________________ Ambassador for other Western Hemisphere countries
This card introduces ______________________________ ______________________________ Ambassador for other Eastern Hemisphere countries	This card introduces ______________________________ ______________________________
This card introduces ______________________________ ______________________________	This card introduces ______________________________ ______________________________

Handout B
SOURCES OF U.S. PETROLEUM IMPORTS
(in nearest thousands of barrels per day)

OPEC Nations		Non-OPEC Nations	
Algeria	487	The Bahamas	85
Indonesia	341	Canada	435
Iran	9	Mexico	536
Libya	547	Netherlands/Antilles	221
Nigeria	863	Puerto Rico	79
Saudi Arabia	1,255	Trinidad/Tobago	179
Venezuela	433	Virgin Islands	379
Others	119	Others	675
Ecuador		Western Europe	
Iraq		Angola	
Gabon		USSR (Russia)	
Kuwait		Rumania	
Qatar		Non-OPEC Arab countries	
		Other Western Hemisphere countries	
		Other Eastern Hemisphere countries	
Total OPEC imports	4,054	Total non-OPEC imports	2,589

Total oil imports in thousands of barrels per day: 6,643 (6.6 million barrels)

Source: *Monthly Energy Review*, January 1981, pp. 27, 32-33.

PURPOSE: To compare the use of energy in children's lifestyles at the turn of the century with the energy usage of today's youth.

LEVEL: Elementary-Junior high school.

SUBJECT: Social Studies, Fine Arts, Language Arts.

CONCEPTS: The production, distribution, and use of energy have environmental, political, social, and economic consequences.

REFERENCE: Coon and Bowman, 1978, p. 15 and pp. 43-44.

MATERIALS: List of questions; paper, paint, crayons for mural.

ACTIVITY:

Ask students to interview someone who is old enough to remember what life was like before the days of great usage of oil and natural gas. (A grandparent or elderly neighbor will likely be very pleased to be asked.) Ask questions such as those below and others that individual students can think of. Ask students to record responses for subsequent reporting and class discussion.

As final questions, ask the person being interviewed to indicate how he or she finds life more enjoyable now as a result of much greater use of energy. In what ways does he or she like "the good old days" better?

After the interviews, divide your class into two groups, asking one group to make a mural of "Yesteryouth" and the other group to construct a mural depicting the lifestyle of today's youth. Each child should be responsible for one item (i.e., a form of recreation, toy, game, or family fun) and a paragraph describing his/her choice.

INTERVIEW QUESTIONS

1. What kind of lights did you use in your home?
   ____
   ____________________ How was it heated? ______________________________

2. What fabrics were clothes made of? Was clothing harder or easier to take care of? ______________________________

3. What sort of washing machine did you have? ______________________________

4. What kind of stove (and what kind of fuel) did your family use for cooking?
____

5. Did you have a refrigerator? What kind? ____________________
How did you keep your food fresh? ____________________

6. How was food packaged when it came from the store? ______________
______________ What did milk come in? ______________

7. What sort of soap did you use? Did it clean as well as the cleaners we have now? ____________________

8. How was your water heated for bathing and laundry? ______________
____

9. Did your family have a car? __________ If not, how did you travel?
How did you get to school? ____________________
____

10. Did you have a radio? What did it look like? ______________
____________________ Did you go to the movies? ______

11. What kinds of entertainment did you enjoy? ______________
____

12. What were some of your favorite games and toys? What kind of family recreation did you enjoy? ____________________
____

DISCUSSION:

1. When the murals are completed, discuss the kinds of energy used by both groups of people. Who used the most energy in their everyday lives--yesterday's youth or today's?

2. What impacts might this greater use of energy have on the world environment? What could you give up to save energy?

3. What do you believe would be an "ideal mix" of old and new lifestyles? (Can be a writing assignment)

4. What changes are likely in the coming years?

PURPOSE: To learn how to determine the number of kilowatt hours used in a home for a week and think of ways to conserve electricity.

LEVEL: Junior high.

SUBJECT: Math, Science.

CONCEPT: The management of natural resources to meet the needs of successive generations demands long-range planning.

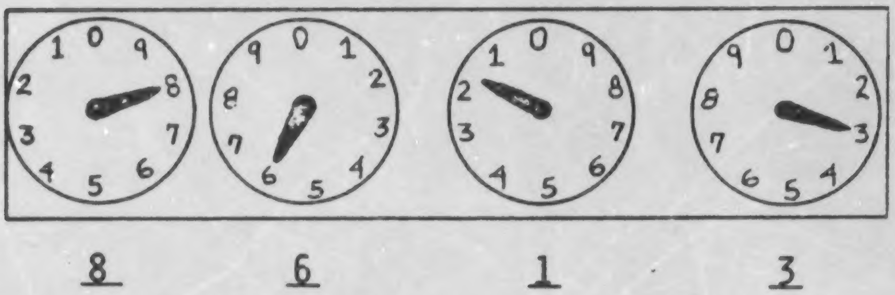
REFERENCE: Coon and Bowman, 1977, pp. 151-154.

MATERIALS: Chart for Recording Meter Readings; Checklist of Electrical Appliances.

ACTIVITY: On some wall of your home--basement, garage, or most often outside--you will find an intricate glass-enclosed device. Through your meter's glass enclosure, you can see a revolving aluminum disk and a series of dials and pointers, or digital numbers. Without explanation, they don't make much sense, but they are really quite simple.

The amount of electricity you use determines the speed at which the disk moves. The more electricity you use, the faster it turns. Each revolution represents a portion of an electric energy unit called watt-hour. This watt-hour measurement is transferred from the disk through a series of gears to the digital numbers or pointers on the dials.

Every hour a 100-watt light bulb burns, it uses 100 watt-hours of electric energy. Since a watt-hour is such a small unit of energy, your electric utility company uses a unit equal to 1,000 watt-hours--a kilowatt-hour--to measure the amount of electricity used. Most meters have four dials, though some commercial meters have five. On each dial is a pointer, pointing to a number on the dial. To record the meter reading, simply write down the number pointed to in each dial, starting from the right-hand dial and proceeding to the left. In the following example the reading is 8613. If the pointer is registering between two numbers on a dial, always record the smallest number. This is important.



Instruct each student to record the meter reading in his home for one week on the following chart. A place for entering the date and time of the reading is provided. A reading should be taken every day at about the same time in order to get 24-hour (one day) intervals.

The first reading is only a starting point, and cannot be used, by itself, for any comparison. This reading is entered in the space to the right of "First Reading."

When the second reading is made, the first reading is subtracted from it, the difference being the number of kilowatt hours used the first day. Enter the difference for each day in the "Difference" column. Similarly, when the third reading is made, the second reading is subtracted from it, and so on, always subtracting the previous day's reading from the current reading and recording the difference in the "Difference" column.

CHART FOR RECORDING METER READINGS

First Reading				
Time: Date:	____________	Difference		
Second Reading				
Time: Date:	____________	____________	=	Day 1
Third Reading				
Time: Date:	____________	____________	=	Day 2
Fourth Reading				
Time: Date:	____________	____________	=	Day 3
Fifth Reading				
Time: Date:	____________	____________	=	Day 4
Sixth Reading				
Time: Date:	____________	____________	=	Day 5
Seventh Reading				
Time: Date:	____________	____________	=	Day 6
Eighth Reading				
Time: Date:	____________	____________	=	Day 7
	Total	____________	=	One Week

Have students record and report totals for one week. The number of kilowatt-hours will likely vary from day to day. It will be interesting to try to account for any variations. Perhaps an increase in electricity use on Monday can be attributed to washing and drying clothes. Find out who in the class uses the greatest amount of electricity; who uses the least. What is the family size of the larger user?

Now give students the following list of electrical appliances found in many homes and check the column that describes their attitude about doing without each item.

	Very Easily	Easily	With some difficulty	With great difficulty	Impos-sible
Radio					
Stereo					
Air conditioning at home					
Dishwasher					
Clothes washer					
Iron					
Electric stove					
Refrigerator					
Lights					
Central heating					
Doorbell					
Electric mixer					
Ice crusher					
Toaster					
Hair dryer					
Television					
Electric guitars					
Electric fans					
Clocks					
Vacuum cleaners					
Electric games					
Microwave oven					
Freezer					
Blender					
Electric blanket					
Typewriter					
Adding machine					
Dentist's drill					
Telephone					
Electric toothbrush					
Electric frying pan					
Hot water heater					
Garbage disposal					
Trash compactor					
Power tools					

Ask students to elicit cooperation from their families for one week to not use the items checked with some difficulty, easily and very easily.

Repeat the meter reading recordings during that week. Was there any difference on final totals? Whose family made the biggest conservation effort? See if this makes a difference on the monthly electric bill.

DISCUSSION:

1. Do individual efforts at saving energy have an impact on the world environment?

2. What benefits are there for the world environment in saving energy?

3. What actions can you take to encourage energy saving on the individual level? On the community level?

VARIATION:

This activity could be enriched by adding a comparison with students in another country. This would have particular significance since the United States has one of the highest levels of energy use per capita in the world and comparison would likely yield substantial differences.

PURPOSE: To examine the effectiveness of cartoons as a medium for depicting energy-related issues.

LEVEL: Junior-Senior high school

SUBJECT: Fine Arts, Language Arts

CONCEPT: The production, distribution, and use of energy have environmental, political, social, and economic consequences.

REFERENCE: Coon and Bowman, 1978, p. 101.

MATERIALS: Newspapers, magazines.

ACTIVITY:

Ask students to make or trace or collect (or a combination of these procedures) cartoons that relate to energy. Herblock, Mauldin and other syndicated cartoonists continue to produce very effective drawings that depict what government is doing or is not doing relative to the energy shortage, the importance of the "oil sheiks" in determining the economic status of western countries, the attitudes of Americans toward saving energy and many other aspects of the energy problem.

Ask students to assemble 15-20 cartoons in a notebook. Each cartoon should be analyzed briefly in terms of (1) the feelings that are being depicted and (2) the extent to which the student agrees or disagrees with the message of the drawing.

DISCUSSION:

How much truth do you think there is to the statements made in the collection of cartoons?

What role do individuals play in creating the situations depicted in the collection?

How might individuals make changes that would improve situations regarding worldwide energy supplies?

PURPOSE: To promote understanding of conflicting arguments about the safety of nuclear power.

LEVEL: Junior-Senior high school - Adult

SUBJECTS: Science, Social Studies

CONCEPT: Presently, most of our energy requirements are met through using fossil fuels. However, there are other alternative sources of energy such as solar, wind, fission, fusion, hydro, and geothermal which must be considered and developed.

REFERENCE: Coon and Bowman, 1978, pp. 107-112.

MATERIALS: Handout (The Great Nuclear Power Debate)

ACTIVITY:

Have students study carefully the contrasting positions stated by proponents and opponents of nuclear power summarized in the handout.

Discuss the article with particular attention to how the truthfulness of the contrasting positiions can be verified. Which arguments are irrefutable? Which "experts" can be trusted? How can you be sure?

VARIATION:

Divide the group in half, and assign each half the opponent or advocate perspective. Provide the appropriate arguments to each group, and allow time for further research.

Break the class into groups of six: three opponents and three advocates. Hold the discusssion in small groups, then share some of the salient points made in the small-group sessions.

THE GREAT NUCLEAR POWER DEBATE
A SUMMARY*

The debate over nuclear energy is heating up again, with opposing positions more solidified than ever. A recent Harris Poll shows 63 percent of Americans favor more nuclear power plants, but another poll shows 40 percent still have no firm opinion. During this year's elections, referenda on allowing construction of more nuclear reactors will appear on ballots of at least two states and recent Congressional hearings have highlighted the issues involved. In this first article of a two-part series we present the contrasting, and often irreconcilable, positions of nuclear advocates and opponents.

Economics

Opponent

Utilities are beginning to realize that nuclear power isn't the blessing it was thought to be. Within the last two years they have cancelled or delayed orders for the equivalent of 130 large nuclear plants. Construction costs range from 10 to 46 percent higher than conventional plants. Uranium prices have tripled over the last two years. Reactors would never have gotten this far (8 percent of the country's power-generating capacity) without huge Government subsidies; before they can develop further, more huge subsidies will be needed to build new enrichment plants to transform natural uranium into the fuel used by reactors. Once built, the reactors have not performed as reliably as hoped, running at less than two-thirds capacity. The breeder reactor looks even worse: development costs are projected to be $11 billion, but the actual cost of building a breeder demonstrator project at Clinch River, Tennessee, has escalated from $700 million in 1972 to $1.7 billion today (1976).

Advocate

Despite construction cutbacks caused by the recession, nuclear energy is still a bargain, generating electricity at 40 percent less than the cost of fossil fuel plants, even after considering construction costs. In 1974 nuclear plants saved the country the equivalent of 163 million barrels of oil--some $2 billion worth. The price of uranium is such a small part of the total cost that it could quadruple again and nuclear energy would still be cheaper than conventional power. The initial Government subsidy of nuclear reactors has long since been surpassed by private investment, and the projected economic benefits of the breeder reactor are more than 12 times the cost. Of the cost increases at Clinch River, 60 percent were due to inflation and 20 percent were due to design changes. Nuclear plants are as reliable as conventional ones: From 1964 to 1973, conventional plants operated an average of eight and one-half months a year; nuclear plants, around nine.

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*Science News, January 17, 1976.

Danger From Accidents

Opponent

The official Government study of reactor safety, the so-called Rasmussen report (SN: 8/31/74, p. 117 and 11/15/75, p. 310) has been severely criticized for underestimating human error (SN: 11/23/74, p. 330) and not adequately considering contamination of land areas by radioactive fallout following a major accident (SN: 5/31/75, p. 286). The study's methodology is questionable, assumptions such as adequate evacuation procedures are unrealistic, and the Environmental Protection Agency says the resulting casualty figures are too low by a factor of 10. Since the report came out, one of the "accidents that couldn't happen" did: A technician at the Browns Ferry, Alabama, reactor complex set fire to the electric control system, while using a candle to check for air leaks. The emergency core cooling system was knocked out, water in the reactor vessel dropped dangerously low, workers argued with firemen for five hours before following their advice on how to extinguish the fire, and no evacuation plans were set in motion.

Advocate

The key finding of the Rasmussen report was that an individual's chances of dying from a nuclear accident are about the same as being hit by a meteorite--one in five billion. This methodology is imprecise but is the most sophisticated available, and a factor of 10 one way or the other is practically meaningless. For workers in all aspects of the nuclear business, the most danger arises in uranium mines, not around reactors, and new mining safety regulations are improving those conditions. The Browns Ferry incident demonstrates just how well the nuclear safety systems are designed to compensate for human error. Despite a fire directly under the control room, no evacuation was needed and no damage was sustained by the reactor, core or coolant piping. Despite loss of control over some of the cooling systems, alternative methods were available and successfully employed. There were no injuries and no release of radioactivity. Regulations governing worker conduct are constantly being updated to prevent accidents.

Environmental Effects

Opponent

In the normal operation of nuclear plants, some radioactive materials will inevitably escape and expose the public. Reactors also give off more waste heat than fossil-fueled plants of the same generating capacity, and this thermal discharge has already adversely affected the ecology of rivers and lakes. The biggest problem, though, is what to do with nuclear wastes. Already 200,000 tons of discarded uranium left over in spent fuel has accumulated in 20,500 steel vessels at Oak Ridge and other sites. Some wastes remain dangerously radioactive for thousands of years--long after steel drums rust away. Not only is there a danger to the public of being exposed to the cancer-causing radioactivity of these wastes, but some of them, including plutonium, are so chemically toxic that accidental ingestion of even very small amounts can cause death. Even if one assumed that secure, long-range storage of these wastes could be found, the cost--including constant guarding for thousands of years--would be very large.

Advocate

The amount of radiation escaping from reactors is miniscule compared with naturally occuring radiation on earth; the average person receives one-ten thousandth as much radiation from the nuclear industry as from natural sources or medical X-rays. Thermal discharge could be used constructively--say, to heat homes, as in some other countries--if the public would accept it. Annual costs of all environmental effects associated with reactors are less than half of those associated with coal-fired plants. Nuclear wastes are really not as much of a problem as some have claimed: long-lived wastes are only half a percent of the total wastes, and these are now molded into insoluble solid masses. By 2010 the total volume of these solid wastes could fit comfortably into a single abandoned salt mine (a very stable geologic formation) at negligible cost. The spent uranium at Oak Ridge is being saved for use in the breeder reactor, where its value could be trillions of dollars. Plutonium is less toxic than many industrial chemicals in common use.

Terrorism

Opponent

Even if the problems of normal reactor operations, occasional accidents, waste transportation and storage could be overcome, no way has been found to calculate the impact of nuclear terrorism, or to adequately prevent it. A nuclear bomb can be made from only 10 to 20 pounds of plutonium, which is copiously produced in every reactor and shipped elsewhere for fuel reprocessing. On an NET television program, an undergraduate student demonstrated how easy it would be to steal some plutonium and design a bomb--which experts from the Swedish Defense Ministry said would explode. But the aim of the American nuclear industry is not just to build reactors here, where some safeguards to exist, but rather to export its technology, inevitably to countries whose obvious political instability will virtually ensure nuclear arms proliferation. To prevent nuclear theft and terrorism in the United States will require establishment of what some have called a "garrison state;" to prevent it abroad, nothing can be done.

Advocate

Relative to the nuclear power debate, the issues of terrorism and proliferation are simply red herrings--there are much easier ways to go about either. In the first place, the "10 to 20 pounds" of bomb material refers only to the weapons-grade, metallic plutonium-239, which never exists as such anywhere in the whole nuclear fuel cycle. It would take from 200 to 900 pounds of unprocessed nuclear fuel to make a very crude bomb, or 25 to 70 pounds of reprocessed plutonium oxide--a much more difficult substance to handle than the weapons-grade metal. Designing a bomb may be simple (though none of the Swedish "experts" had actually ever built one), but preparing materials requires an extensive industry, and assembling the device without cooking oneself is actually quite a trick. Conventional terrorism is a more immediate threat to civil liberties, and the best way to encourage responsibility among developing countries is through creation of a working partnership, based on such projects as nuclear power.

Alternatives

Opponent

Ultimately, the reason nuclear power development should be halted is that so many better alternatives are available, and needed development funds have been usurped by nuclear research. Some 40 percent of the energy consumption in the United States is unnecessary to begin with, according to some estimates. Savings of that amount could easily be obtained in buildings and cars, through careful redesign. The unemployment picture could be brightened if we let people take back some of the jobs machines took from them. For energy increases over the short term, more coal could be used if the proper environmental protection devices were installed. Geothermal, solar and wind energies are waiting to be tapped in endless supply in various geographical areas and these alternate sources have the added advantage of lending themselves to small, labor-intensive development. Finally, if one insists on nuclear energy, why not wait until the much safer fusion process is perfected, probably in the next century?

Advocate

Ultimately, the reason nuclear power must be developed is that no other viable alternatives are available, despite greatly increased funding. The wasteful elements of society cannot be changed overnight; the best estimate is that conservation can hold down total energy growth to 2 percent a year--still fast enough to double demand in 35 years. Even modifying 10 percent of the country's homes to solar heat would save at most 1.5 percent of our energy needs, but would cost at least $70 billion. Energy and jobs go together--just restricting oil imports to their 1973 levels would ensure a 10 percent unemployment rate over the next 15 years, if history is any guide. Power-generating plants using solar or wind energy are now extremely expensive, causing the power they would generate over their lifetimes to cost two or three times as much as that from nuclear or coal. Opening new coal mines and power plants and installing pollution devices will take years and a huge investment. Fusion is still chancy.

TRANSPORTATION

PURPOSE: To estimate the amount of space used by automobiles in one block.

LEVEL: Upper elementary.

SUBJECTS: Mathematics, Science.

CONCEPT: People have developed techniques useful in describing land and its uses.

REFERENCE: Fielder and Shaffer, 1976.

ACTIVITY:

As a class, measure the perimeter of one city block. Figure out the approximate area of the block. Divide your class into four teams, each stationed on one perimeter line of the chosen block. Ask each team to record the following:

1. Number of cars parked either in the street or in driveways.
2. Number of garages.
3. Number of driveways and alleys.
4. Number of parking lots.
5. Estimated amount of space cars take on each perimeter line: 1/4, 1/2, 3/4. This could be done by pacing and measuring.

   Back in the classroom, record each group's findings and estimate the amount of space used by cars for the entire block.

DISCUSSION:

1. Imagine that all the people on this block switched from cars to bicycles. What might they do with the extra space? Remember that private automobiles are no longer available for transportation.
2. Investigate the environmental impacts of paving. How might paving in one area affect people in other areas? Can paving and automobile use affect people in adjacent countries (Canada, Mexico)? How about overseas countries?
3. If the United States used fewer cars, and thus required less space for automobiles, what impacts would there be on the surrounding environment? On other countries?

PURPOSE: To organize and analyze data relevant to automobile use in the community; to explore ways in which alternative uses of motor vehicles could improve environmental quality.

LEVEL: Upper elementary.

SUBJECT: Social Studies, Mathematics.

CONCEPT: There is great potential for reducing energy usage through simple changes in driving habits.

REFERENCE: Liston, 1980.

MATERIALS NEEDED:

Graph paper for tabulating data.
Paper and pencils.

PREPARATION FOR THE ACTIVITY:

1. Contact a classroom teacher in another country and arrange to conduct the activity simultaneously and share results.

ACTIVITY:

1. Divide the class into four teams. Tabulate the size and number of cars, buses, motorized bicycles passing corners of the school and the number of people in each vehicle. Team will work in groups of two - one will observe and count, the other will record. Each pair will record data as small cars, large cars and buses, the number of passengers in each. All teams use the same code: S 1 (small car and driver only), S 3 (small car, driver and two passengers), L 2 (large car and two people), BL (bus light load, B F (bus full load), etc.

2. For more accuracy, different times of the day should be used and several days ought to be used for sampling.

3. The whole class should have a briefing session before the tabulating is done so that all are in agreement on code used and how to judge the fullness of bus and size of car.

4. When teams return they will record their data on nine different sheets. Example:

   a. Friday 8:30-8:50 a.m.
   b. Friday 10:45-11:10 a.m.
   c. Friday 12:30-12:50 p.m.
   d. Monday 8:30-8:50 a.m.
   e. Monday 10:45-11:10 a.m.
   f. Monday 12:30-12:50 p.m.
   g. Tuesday 8:30-8:50 a.m.
   h. Tuesday 10:45-11:10 a.m.
   i. Tuesday 12:30-12:50 p.m.

5. On the day that organizing of data is to be done, form the class into nine groups. Each group will take one master sheet of data and organize it by counting each classification. Example: S1; S 2 or 3; S 4 or more; L 1; L 2 or 3; L 4 or more; B L; B M; B F. Total of tabulations should equal total of cars listed. When each group finishes the count and checks, the talleys can be put on squared paper and some totals can be figured.

DISCUSSION:

1. Can you form any conclusions about how people are using motor vehicles?
2. Can you suggest some ways we can use automobiles and buses to economize or save gasoline?
3. Did you have any difficulty with the collecting of data? If so, can you suggest how the method can be improved?
4. Did you meet with any reactions from people as you collected your data?
5. How do the results from your community compare with the results from a a community in another country? In which community are motor vehicles used most wisely? Which country would have the least environmental problems associated with motor vehicle use?

PURPOSE: To assist students in developing an awareness of how their use of the automobile has an effect on other countries of the world.

LEVEL: Junior high school

SUBJECT: Social Studies, Mathematics

CONCEPT: Most of materials used to make the automobiles manufactured in this country are imported.

REFERENCE: Stapp, et al., 1981, pp. 42-49.

MATERIALS:
Copies of the 3 handouts provided for each student
Rulers - one per student
Newsprint and markers

ACTIVITY:

1. Have students form in groups of three and do the following as groups:
    a. List on paper the five most important materials used in a standard 1981 Ford automobile.
    b. For each of the five materials identified, what percentage (%) of the raw materials does your group think is imported into the United States?
2. When groups complete the above two tasks, hand out copies of the information sheet "Materials Used In Manufacturing Process."
3. Have students compare their group answers with the actual answers. Have a class discussion. This could include:
    a. What surprised the students?
    b. The number of materials used in making an automobile.
    c. The number of materials imported.
    d. The number of countries involved in making an automobile.
    e. The percentages of some of the materials imported, especially aluminum.
    f. What does this information mean as to our relationship with foreign countries?
4. A recommended optional activity for the class, or a few individuals, would be to mark on a class map the countries that export materials to the U.S.

5. Hand out copies of the enclosed graph of "Projected Aluminum Use." Have students plot the data points and connect the points with a ruler. Ask students what the graph means to them. How might this trend relate to the % of bauxite imported in the U.S. in the future?

6. Explain to the students that they are now going to enact a simulation of a hypothetical future problem. Divide the class into groups of 3 to 5. Hand each person a copy of "Aluminum Simulation." Explain that each group is a different group of Presidential Advisors who have been instructed to develop a plan of action for the President of the U.S.

7. Give the students a couple of minutes to read the instructions, and then allow 15 to 20 minutes for them to develop their plan. Emphasize creativity. Explain that the possible actions given are just a few suggestions to get the students thinking in the right direction and are by no means the only alternatives.

8. At the end of the planning time, have each group write their plan on newsprint and make a short presentation to the other 'advisory groups,' that is, the rest of the class.

DISCUSSION:

Discussion could include:

1. Of the various plans presented: Which one seems more practical? Which one seems best ideally?

2. Implications of the various "plans" presented.

3. Countries' rights to regulate the export of materials that other countries are dependent upon.

4. The political implications of depending on resources of another country and the use of this dependency in world trade bargaining.

5. The rights of a country to exploit the resources of another country and the reasons why this happens.

The understanding to leave with the students is that international/global problems do not have simple solutions. In order to solve many of our transportation problems we not only need to cooperate with one another, but use creative thinking, hard work, and perhaps even a change in lifestyle (e.g., no longer using aluminum foil, in the event of a shortage).

MATERIALS USED IN AUTOMOBILE MANUFACTURING PROCESS

Ford Co.
1979

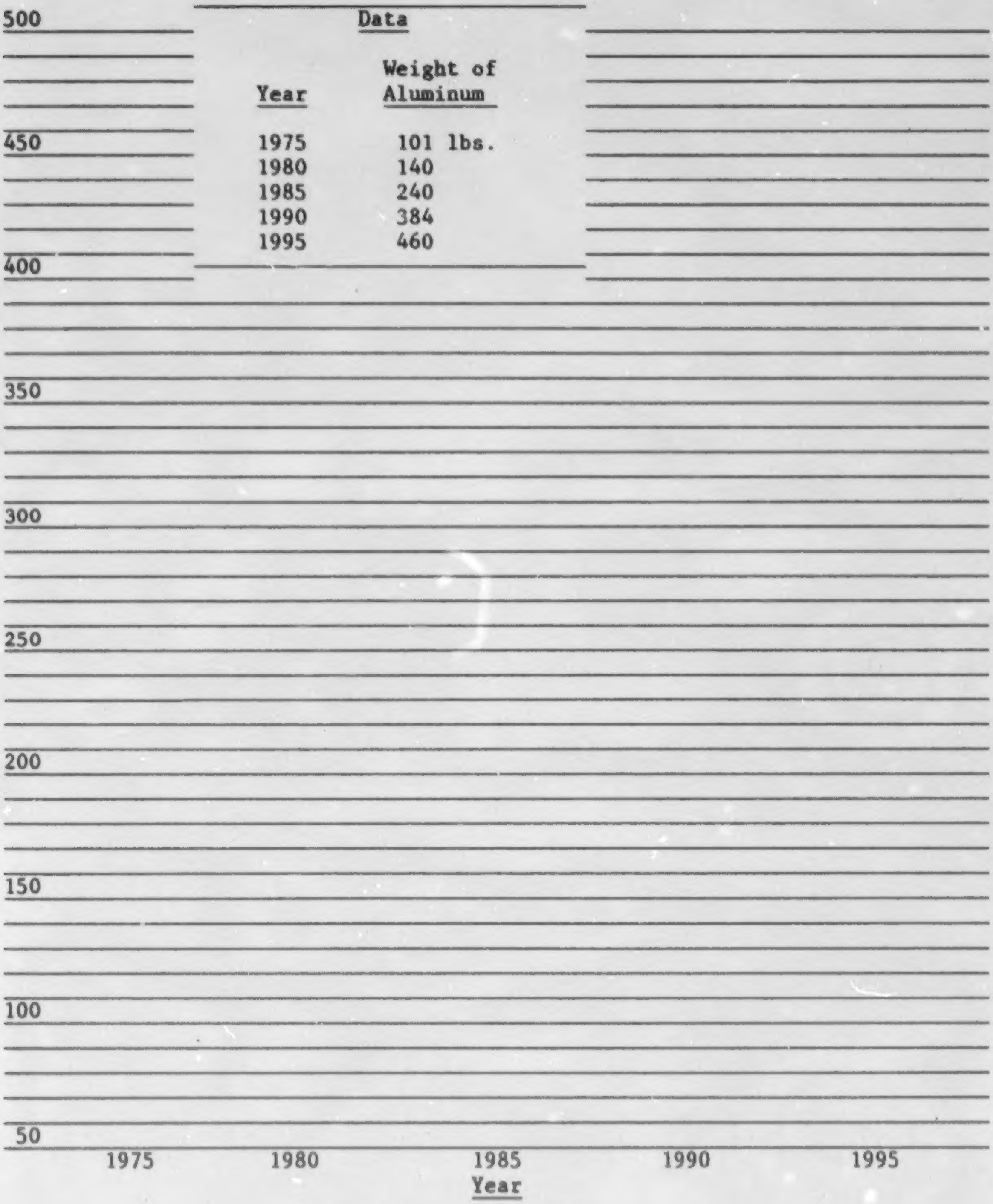
Major Materials	Lbs/Avg. 1980 Car	U.S. Import Reliance
Steel	1871	33% Iron Ore: Canada, Venezuela, Brazil, Liberia
Cast Iron	472	13% Iron & Steel: Japan, Europe, Canada
Plastic	227	50% Petroleum: Saudi Arabia, Iran, Kuwait, Venezuela, etc.
Rubber	145	50% Petroleum: Same as Plastic
Aluminum	79	None
Sound Deadener	59	None
Copper/Brass	35	17% Copper: Canada, Chile, Peru, Zambia
Lead	25	14% Lead: Canada, Peru, Mexico, Australia
Zinc	12	58% Zinc: Canada, Mexico, Australia, Peru
Minor Materials	55	
Antimony		52% S. Africa, Peoples Republic of China, Bolivia
Asbestos		80% Canada, South Africa
Barium		40% Peru, Ireland, Mexico
Boron		None
Cadmium		51% Canada, Australia
Calcium		None
Chlorine		None
Chromium		89% S. Africa, USSR, Turkey, S. Rhodesia
Cobalt		97% Zaire, Norway, Finland, Belgium-Lux.
Columbium		97%-100% Brazil, Thailand, Nigeria, Malaysia
Flourine		80% Mexico, Spain, Italy, South Africa
Manganese		97%-100% Brazil, Thailand, Nigeria, Malaysia
Mercury		46% Spain, Algeria, Mexico, Yugoslavia
Molybdenum		None
Nickel		70% Canada, Norway, New Caledonia, Dom. Rep.
Platinum Group		92% Africa, USSR, UK
Silicon		None
Sulfur		None
Tin		86% Malaysia, Thailand, Bolivia, Indonesia
Titanium		38% Canada, Australia, S. Africa, Chile, USSR
Tungsten		38% Canada, Bolivia, Peru, Thailand
Vanadium		38% Canada, Australia, S. Africa, Chile, USSR

MATERIALS USED IN AUTOMOBILE MANUFACTURING PROCESS

Ford Co.
1979

Major Materials	Lbs/Avg. 1980 Car	Use
Steel & Cast Iron	2340	Numerous Structural and Mechanical Parts; Body Panels; Castings
Plastic	227	Interior Body Components; Exterior Ornamentation
Rubber	145	Tires; Hoses; Seals; Vibration Insulators
Aluminum	140	Bumpers; Hoods; Decklids; Manifolds; Radiators; Pigments
Glass	79	Windshield, Rear Windows; Side Windows; Lamps
Sound Deadener	59	Noise Level Abatement
Copper/Brass	35	Radiators; Bearings; Tubing; Electrical Wiring; Alloys
Lead	25	Batteries; Solder; Alloys
Zinc	12	Galvanizing; Alloys; Castings
Minor Materials	55	
Antimony		Batteries; Fire Retardants
Asbestos		Friction Materials; Gaskets; Insulators
Barium		Base Oils; Greases
Boron		Steel Alloys; Electronic Components
Cadmium		Color Pigments, Plating
Calcium		Agent in Steel Products; Alloying Agent for Copper and Aluminum
Chlorine		Rubber; Plastic; Solvent
Chromium		Steel Alloys; Plating
Cobalt		Steel Alloys; Color Pigments
Columbium		Steel Alloys
Fluorine		Plastics; Refrigerants
Manganese		Steel Alloys
Mercury		Electrolysis of Other Important Elements
Molybdenum		Steel Alloys; Plating
Nickel		Steel Alloys; Plating
Nitrogen		Annealing of Steel; Synthesis of Some Rubber and Plastics; Float Glass Manufacturing
Oxygen		Copper Smelting, Steel Production; Chemical Intermediate
Platinum Group		Catalysts
Silicon		Steel and Aluminum Alloys; Silicone Rubber and Fluids; Silicone Carbide Abrasives; Electronic Components
Sulfur		Rubber Vulcanization; Paper Manufacturing
Tin		Plating; Bushings; Solder; Alloys
Titanium		Steel Alloys
Tungsten		High Temperature Alloys; Carbide Tools
Vanadium		Steel Alloys

PROJECTED ALUMINUM USE IN FORD CARS



Data

Year	Weight of Aluminum
1975	101 lbs.
1980	140
1985	240
1990	384
1995	460

ALUMINUM SIMULATION

Aluminum is being used more and more each year by the automobile industry in place of other metals. Using light-weight aluminum in place of the heavier steel alloys gives automobiles better gas mileage and helps the automobile industry meet the federal gas mileage requirements. Aluminum is made from bauxite, and since bauxite is a scarce natural resource in this country, almost all of it used by the auto industry must be imported.

As a group of presidential advisors, you are faced with this situation: The four bauxite exporting countries (Australia, Jamaica, Surinam, and Guinea) decide that this resource is too valuable for them to be selling as fast as they are, and reduce their exports by 50%. Your job is to develop a plan of action in response to this problem and present your plan to the other groups of advisors (the rest of the class).

A few possibilities are:

1. Force the countries to sell their bauxite by using military force.
2. Build heavier cars using more steel alloys (which will reduce gas mileage).
3. Build fewer cars.

However, consider the following:

1. Since many smaller countries now possess nuclear weapons, any military force against these countries could have serious consequences.
2. Our country has a decreasing supply of gasoline for automobiles, and increasing gas mileage is of prime importance to prevent a bigger fuel crisis.
3. 1 out of 6 jobs in this country is related to the automobile. Cutbacks in the manufacture of automobiles will raise the country's unemployment rate.

PURPOSE: To examine variations in the price of gasoline around the world and use the resulting information to speculate about driving habits, gasoline consumption and energy conservation as a global trend. To explore alternatives to automobile transportation.

LEVEL: Junior High School

SUBJECT: Social Studies, Mathematics

CONCEPT: There is great potential for reducing energy usage through simple changes in driving habits.

REFERENCE: Johnson and Benegar, 1981, pp. 37-42.

MATERIALS: Handout A ("Fill 'er Up"), Handout B ("Fill 'er Up Worksheet"), Handout C ("Bus and Subway Fares Around the World"); large world map; world almanacs and atlases; construction paper, crayons or markers, scissors, thumbtacks or pushpins.

PREPARATION FOR THE ACTIVITY:

Cut apart the car data cards on Handout A ("Fill 'er Up"). To facilitate handling of the cards, you might want to glue them onto cardboard backing sheets before cutting them apart. You will need to duplicate one or more of the handout sheets so that every student will have a card. Make copies of Handout B for all the students. Duplicate enough copies of Handout C for small groups of three or four students.

Several days before using this activity, ask each student to find out and bring to class information about the year and model of a family car or other motor vehicle and its approximate gas mileage (how many miles it can go on each gallon of gas). Explain that the mileage information does not have to be exact; a rough estimate will do. Students whose families do not have cars can telephone automobile showrooms or car rental agencies to obtain information about models and mileage ratings.

ACTIVITY:

1. Introduce the activity by asking whether anyone knows the current price of a gallon of gasoline at a local service station. Is the price of gasoline the same (in U.S. dollar equivalents) all over the world? What factors might cause the price of gasoline to be lower than it is in the United States? What factors might make it higher? Explain that in this activity students will be exploring the price of gasoline around the world, using prices that were correct as of early 1981.

2. Distribute the car data cards from Handout A or allow each student to pick one. Allow time for the students to locate the countries on their data cards on the large world map, using atlases or almanacs if necessary.

3. Distribute construction paper, markers, and scissors and let each student make a small, simple symbol (for example, a gasoline pump or a simplified car like the one on the data card). Ask each student to print the name of his or her country and the price of a gallon of gasoline in that country on the symbol and attach it to the large world map at the approximate location of that country.

4. After all the symbols have been attached, allow time for students to examine the map carefully. Which country had the most expensive gasoline in 1981? (South Korea: $4.50.) Which country had the cheapest? (Saudi Arabia: $0.31.) How do these prices compare with the current price of gasoline in their own community?

5. Tell the students to fill in their data cards with information about their own family cars or other vehicles (year, model, and approximate gas mileage). Tell them to assume that each one lives in the country shown on his or her data card and must pay the price shown for a gallon of gasoline. Explain that, because the capacities of gas tanks differ, everyone should assume that the gas tank of his or her car will hold ten gallons of gas. Ask them to use all this information to figure out the number that fit in the blanks of their data cards. (Note: You may want to let students use hand-held calculators for this part of the activity.) An example of the information that should appear on a completed data card is shown below:

   ISRAEL
   $3.00 per gallon
   Car model: 1976 Buick Electra
   Miles per gallon: 12
   Miles traveled on a full tank: 120 (12 x 10)
   Cost: $30.00 ($3.00 x 10)

For your convenience, a list of the countries and gasoline prices (as of early 1981) is provided here.

Country	Price
Algeria	$1.05
Argentina	1.60
Australia	1.78
Brazil	2.80
Canada	0.95
Chile	1.85
China	2.10
Egypt	0.71
France	2.70
Iceland	3.50
Indonesia	0.90
Iran	1.50
Iraq	0.75
Ireland	3.00
Israel	3.00
Italy	3.40
Japan	2.79
Jordan	1.60
Kuwait	0.57
Libya	0.95
Mexico	0.53
Nigeria	2.30
Poland	2.05
Saudi Arabia	0.31
South Africa	2.89
South Korea	4.50
Spain	3.00
Sri Lanka	1.95
Sweden	2.80
Turkey	1.80
United Arab Emirates	1.00
United Kingdom	2.80
United States	1.44
USSR (Russia)	1.14
Venezuela	0.35
West Germany	2.60

6. When all the students have finished filling in their data cards, post them in the front of the room. Distribute copies of Handout B and allow about 20 minutes for students to try to answer the questions. (Note: You may want to let the students work in pairs or small groups, and use hand-held calculators, to speed up this part of the activity.)

7. Conclude this part of the activity by asking the following discussion questions: How might people's driving habits be affected by the country or part of the world they live in? If you were shopping for a car, would the place you live affect your choice of make and

model? Why? What countries do you think have the most cars per capita (for each person)? Which countries would be likely to have the fewest cars? Why? What factors other than the price of gasoline might influence the number of cars per capita in a country? What are some of the environmental impacts of automobile use? How might these impacts vary in different countries? Which countries face the least severe environmental problems due to automobile use?

8. Make sure that students understand the term per capita. Explain that a useful way of making comparisons between countries is to find out how much of a given resource each country has to divide among its people. If a resource were divided equally, would there be a lot for each person, very little for each person, or some amount in between? Point out that a resource might consist of money, automobiles, refrigerators, books, schools, television sets, water, jobs, houses--anything that people need and use. Emphasize that knowing how much of a given resource a country has tells us very little unless we know how many people have to share that resource. For example, suppose there are 10 million automobiles in the country of Urbania and only 1 million automobiles in the country of Ruralia. In which country would a citizen be more likely to own an automobile? (Students should point out that they need more information before they can answer that question--specifically, they need to know the population of each country.) Now, suppose you know that 100 million people live in Urbania and only 1 million people live in Ruralia. Which country is "richer" in automobiles? How many cars per capita are there in Ruralia?

9. Tell students to retrieve their car data cards and almanacs to find the per-capita incomes for the countries on their data cards. Ask the student with the data card for the United States to write the per-capita income for the United States on the chalkboard. Tell each student to compare the per-capita income for his or her country with the number for the United States. Is it higher or lower? What percentage of the per-capita income in that country would it take to buy a full tank of gas? In which country or countries could most citizens most easily afford to buy gasoline? In which countries could residents least afford to buy gasoline?

10. Allow a few minutes for the class to brainstorm alternatives to automobile transportation and record the answers on the chalkboard. How many students have used each form of transportation? If your community has a bus and/or subway system, ask whether students know the price of a fare. (Note: In many communities, fares vary according to times of day, distances traveled, or special status of riders. In this activity, the lowest regular adult fare will be used for purposes of comparison.)

11. Ask whether students think that bus and subway fares are different in other parts of the world. In what cities or countries might they be cheaper? In what places might they be more expensive? Why?

12. Divide the class into groups of three or four students and give each group a copy of Handout C. Let students use the information on the handout and the prices posted on the world map to answer the following discussion questions: How does the bus fare in Rome compare with the price of gasoline in Italy? How do those figures compare for Israel? What means of transportation would they choose if they lived in Rome? In Tel Aviv? Why? Is there any relationship between the price of gasoline and the price of a bus fare? Explain.

13. Conclude the activity by asking students to hypothesize about how our life style might change as the price of gasoline goes up. How high would the price have to rise before most people stopped driving their personal cars? What might they do instead? What could we learn from people who live in countries in which there are very few automobiles? What might happen to the world environment if most people stopped driving their personal cars?

The gasoline prices used on the car data cards were obtained from the April 1981 issue of Geo magazine, which prints updated figures every six months in its "Geosphere" section. Since these prices vary daily, along with currency conversion rates, the figures shown may not be even relatively accurate by the time this activity is used. The most current figures available can be obtained by writing to Stephen Brewer, Associate Editor, Geo, 450 Park Avenue, New York, NY 10022. Information about bus and subway fares, which change less frequently, can be obtained from the consulates and tourist information offices of the various countries. Information on gas mileage for vehicles made in the United States is available free from the Environmental Protection Agency or from the U.S. Department of Energy's Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830.

Handout A

FILL 'ER UP!

CANADA
$.95 per gallon

Car model ____________________

Miles per gallon __________

Miles traveled per full tank __________

Cost ______________

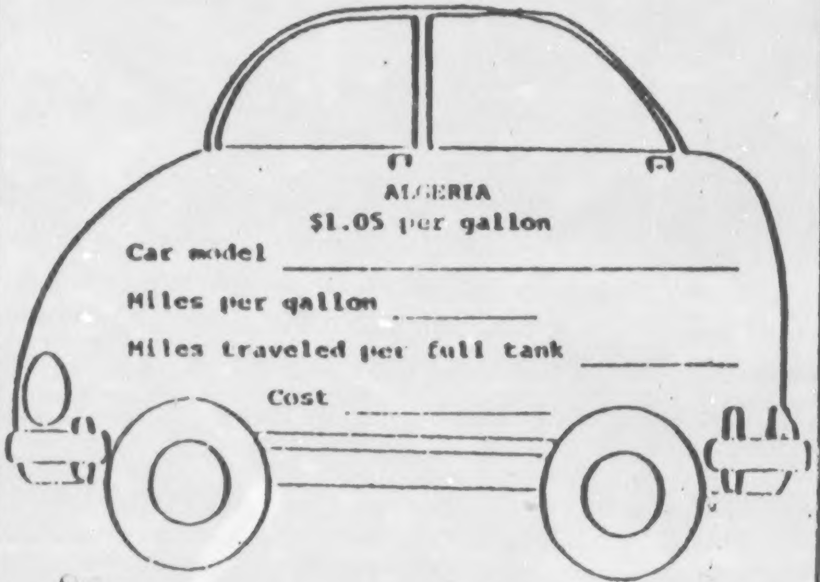
UNITED ARAB EMIRATES
$1.00 per gallon

Car model ____________________

Miles per gallon __________

Miles traveled per full tank __________

Cost ______________



ALGERIA
$1.05 per gallon

Car model ____________________

Miles per gallon __________

Miles traveled per full tank __________

Cost ______________

USSR (RUSSIA)
$1.14 per gallon

Car model ____________________

Miles per gallon __________

Miles traveled per full tank __________

Cost ______________

Handout A

FILL 'ER UP!

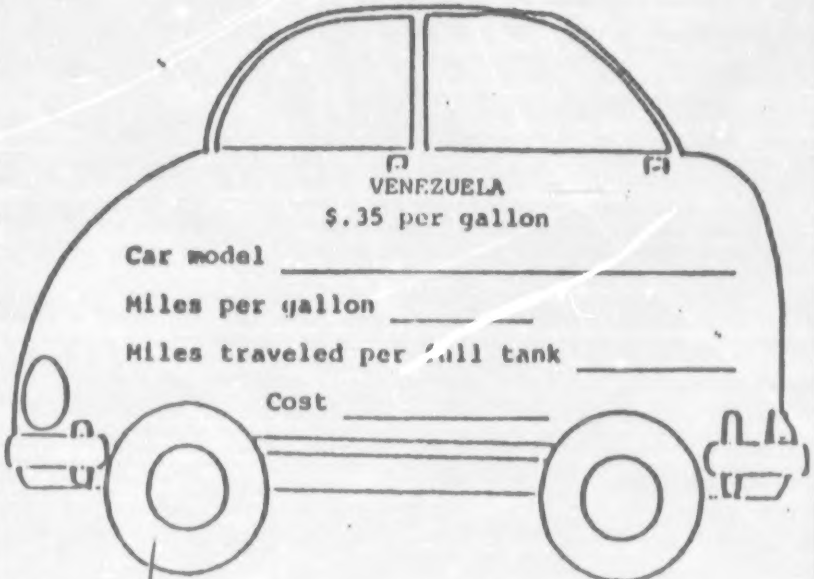
SAUDI ARABIA
$.31 per gallon

Car model ____________________

Miles per gallon ________

Miles traveled per full tank ________

Cost ____________



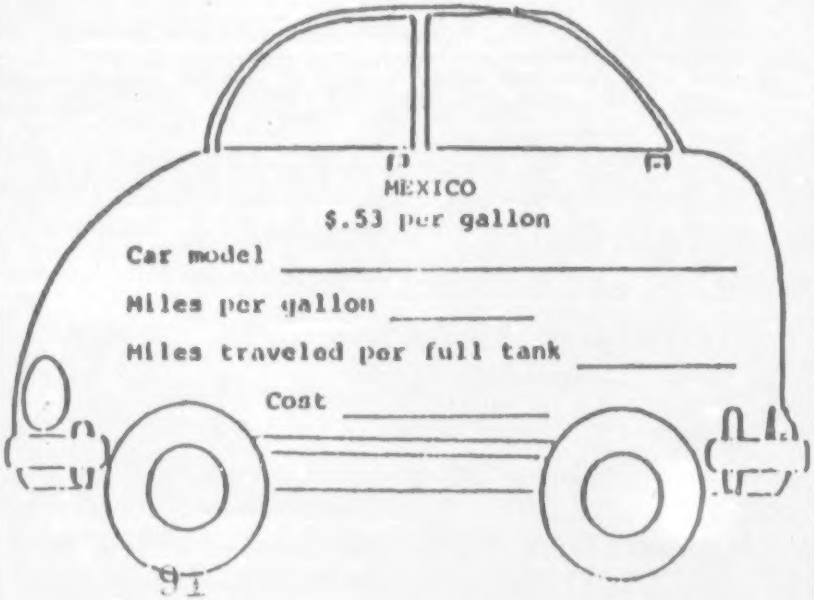
VENEZUELA
$.35 per gallon

Car model ____________________

Miles per gallon ________

Miles traveled per full tank ________

Cost ____________



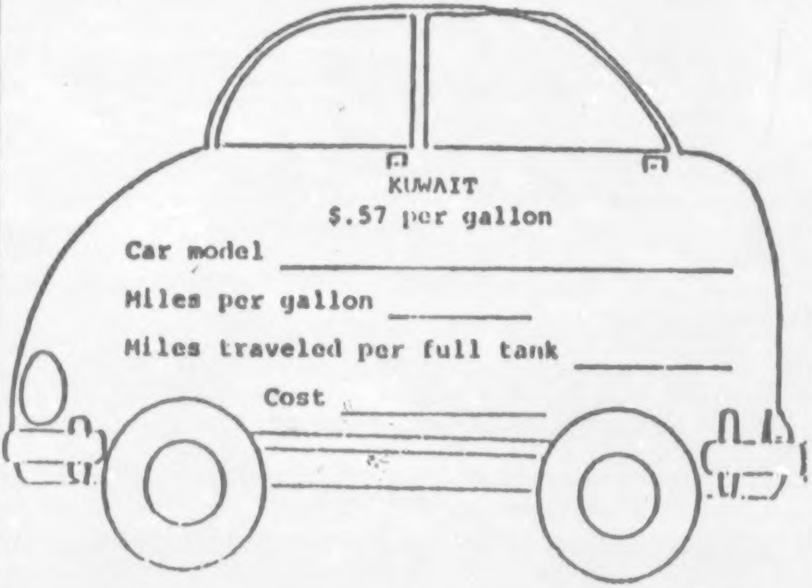
MEXICO
$.53 per gallon

Car model ____________________

Miles per gallon ________

Miles traveled per full tank ________

Cost ____________



KUWAIT
$.57 per gallon

Car model ____________________

Miles per gallon ________

Miles traveled per full tank ________

Cost ____________

Handout A

FILL 'ER UP!

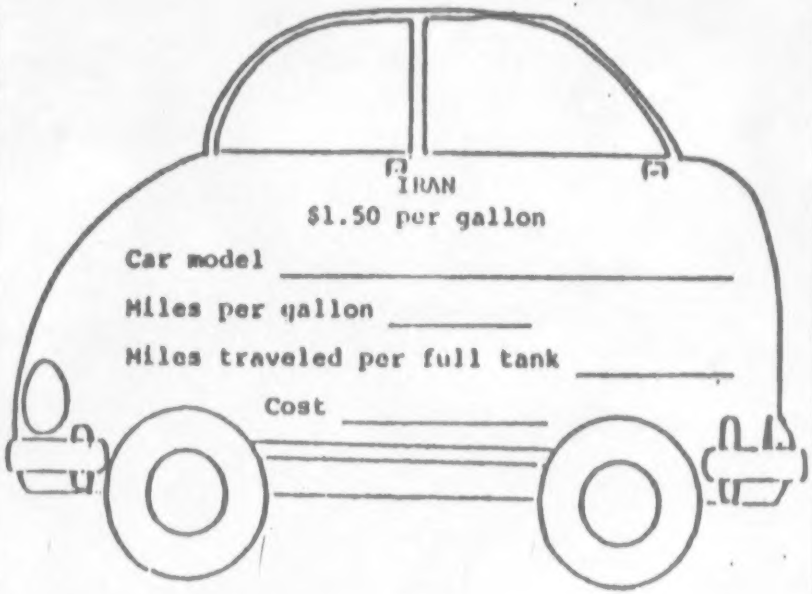
UNITED STATES
$1.44 per gallon

Car model ______________________

Miles per gallon __________

Miles traveled per full tank __________

Cost ______________



IRAN
$1.50 per gallon

Car model ______________________

Miles per gallon __________

Miles traveled per full tank __________

Cost ______________

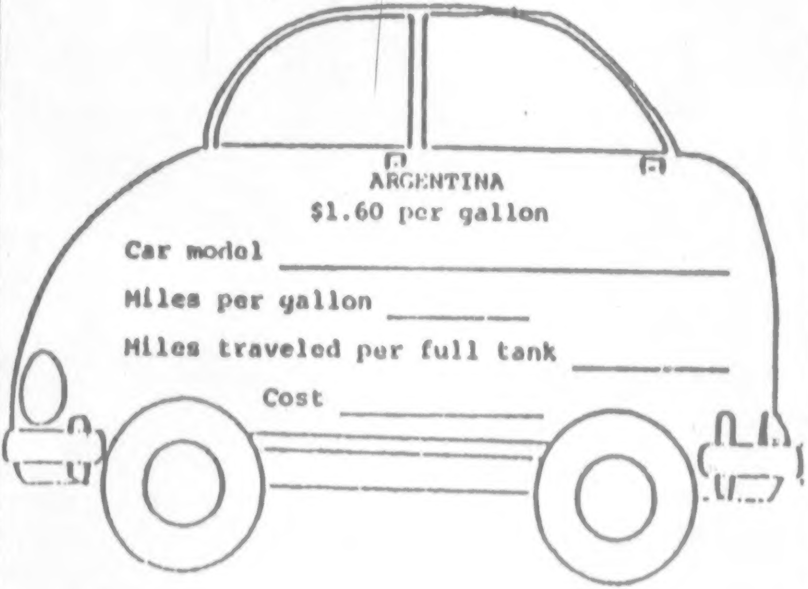
JORDAN
$1.60 per gallon

Car model ______________________

Miles per gallon __________

Miles traveled per full tank __________

Cost ______________



ARGENTINA
$1.60 per gallon

Car model ______________________

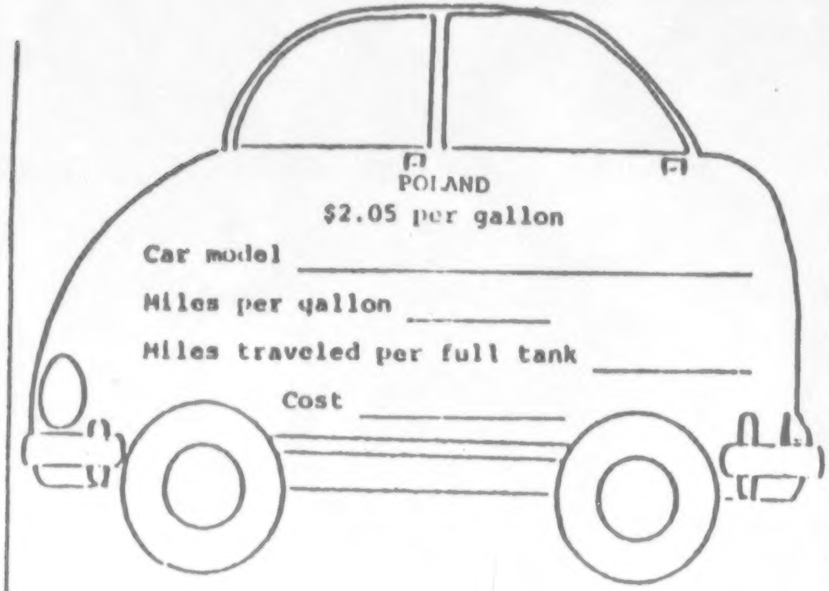
Miles per gallon __________

Miles traveled per full tank __________

Cost ______________

Handout A

FILL 'ER UP!



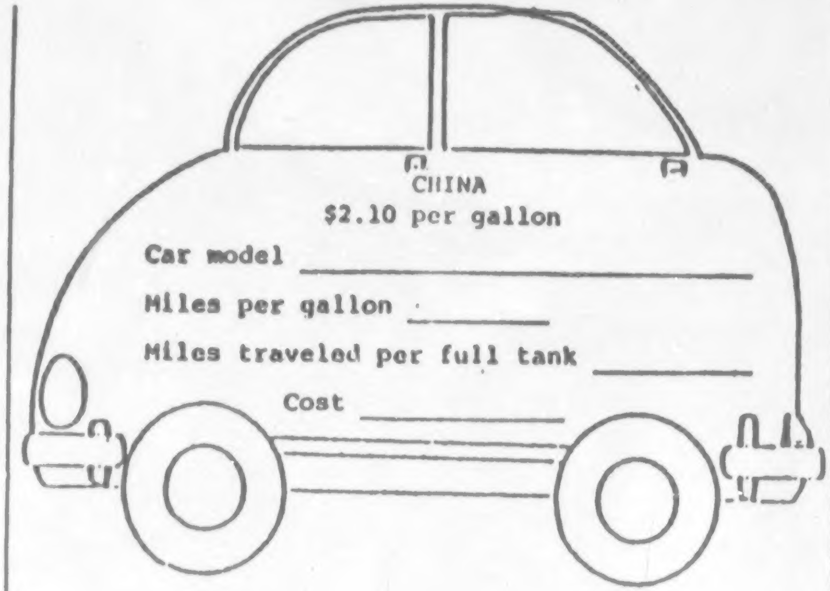
POLAND
$2.05 per gallon

Car model ____________________

Miles per gallon ________

Miles traveled per full tank ________

Cost ____________



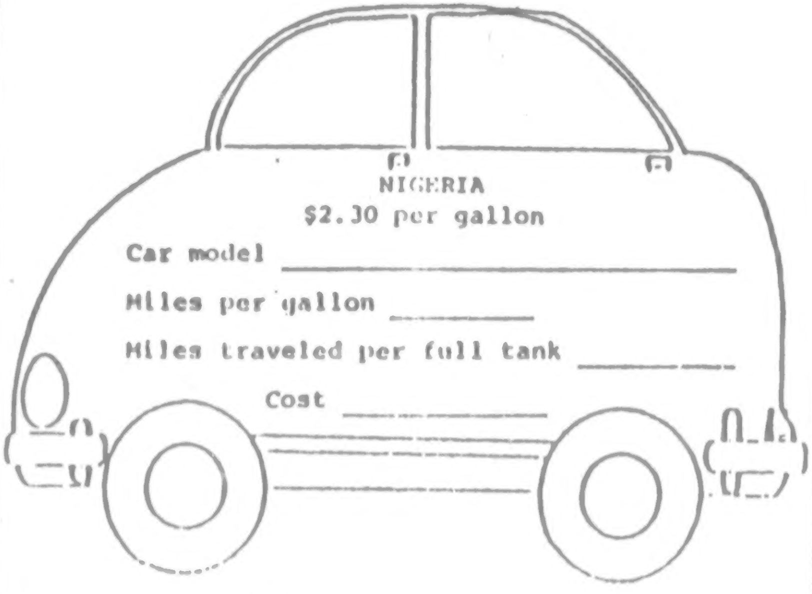
CHINA
$2.10 per gallon

Car model ____________________

Miles per gallon ________

Miles traveled per full tank ________

Cost ____________



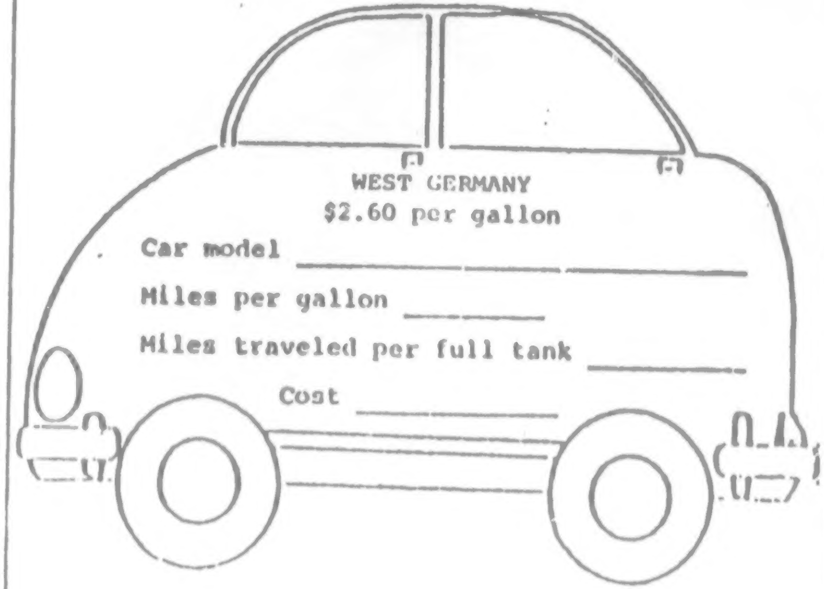
NIGERIA
$2.30 per gallon

Car model ____________________

Miles per gallon ________

Miles traveled per full tank ________

Cost ____________



WEST GERMANY
$2.60 per gallon

Car model ____________________

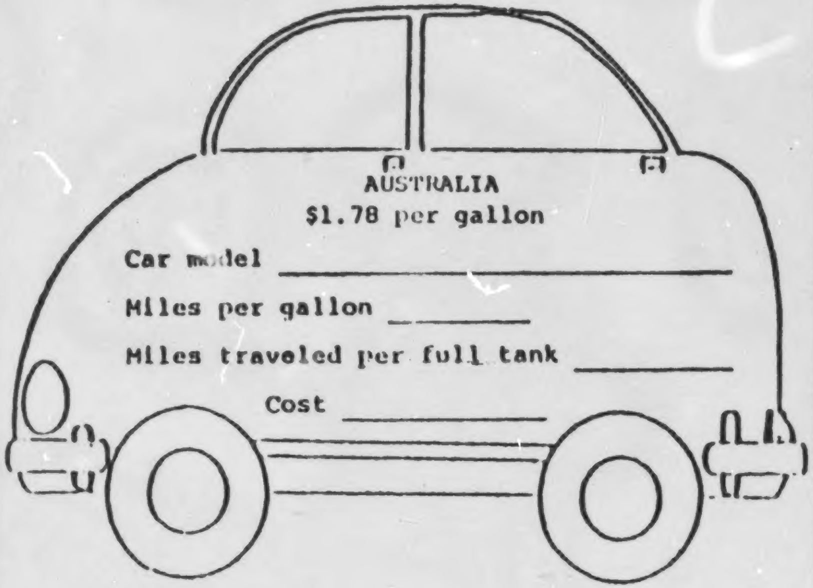
Miles per gallon ________

Miles traveled per full tank ________

Cost ____________

Handout A

FILL 'ER UP!



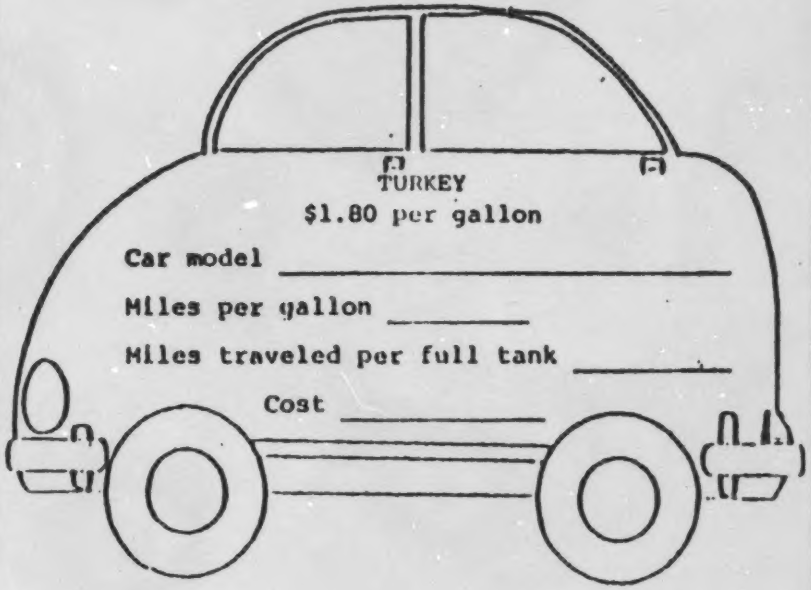
AUSTRALIA
$1.78 per gallon

Car model ____________

Miles per gallon ________

Miles traveled per full tank ________

Cost ________



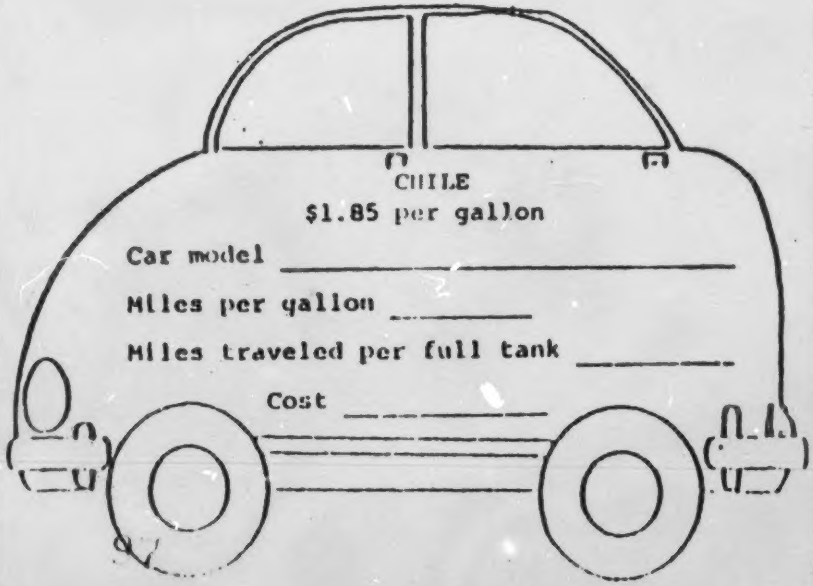
TURKEY
$1.80 per gallon

Car model ____________

Miles per gallon ________

Miles traveled per full tank ________

Cost ________



CHILE
$1.85 per gallon

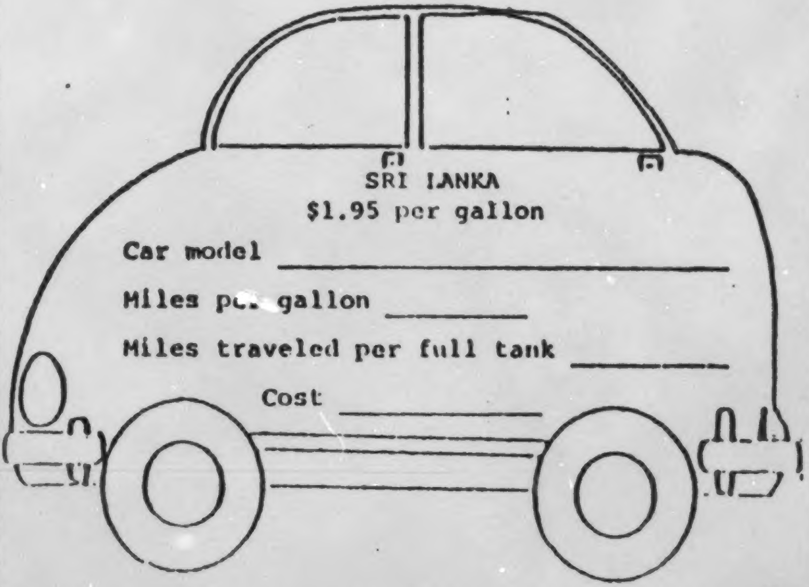
Car model ____________

Miles per gallon ________

Miles traveled per full tank ________

Cost ________

97



SRI LANKA
$1.95 per gallon

Car model ____________

Miles per gallon ________

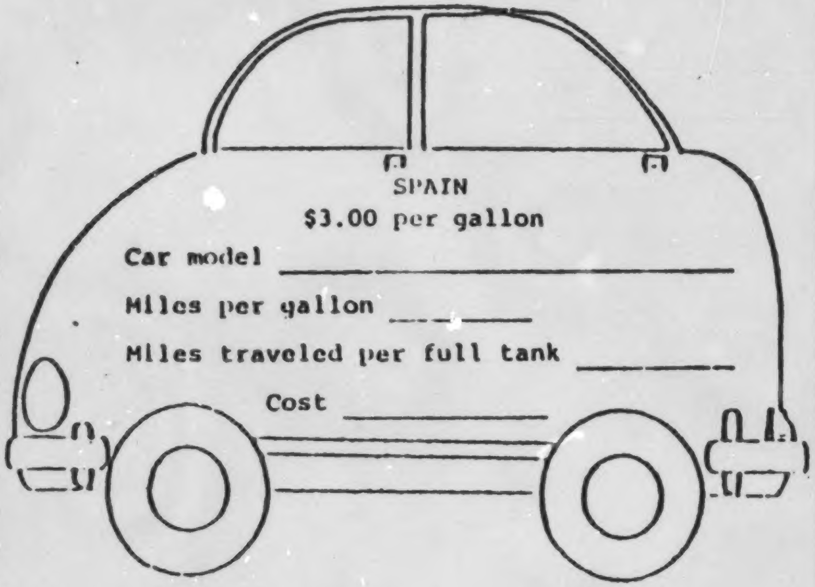
Miles traveled per full tank ________

Cost ________

98

Handout A

FILL 'ER UP!



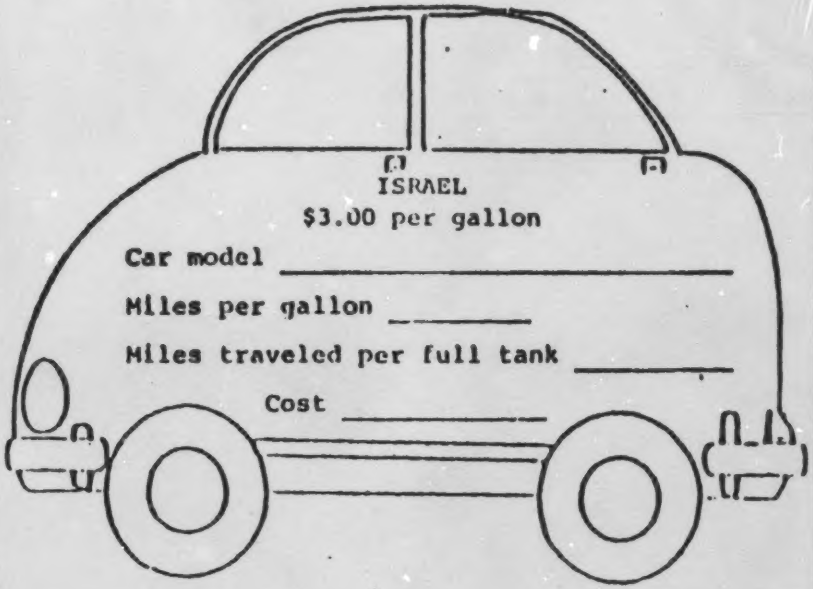
SPAIN
$3.00 per gallon

Car model ________________

Miles per gallon ________

Miles traveled per full tank ________

Cost ________



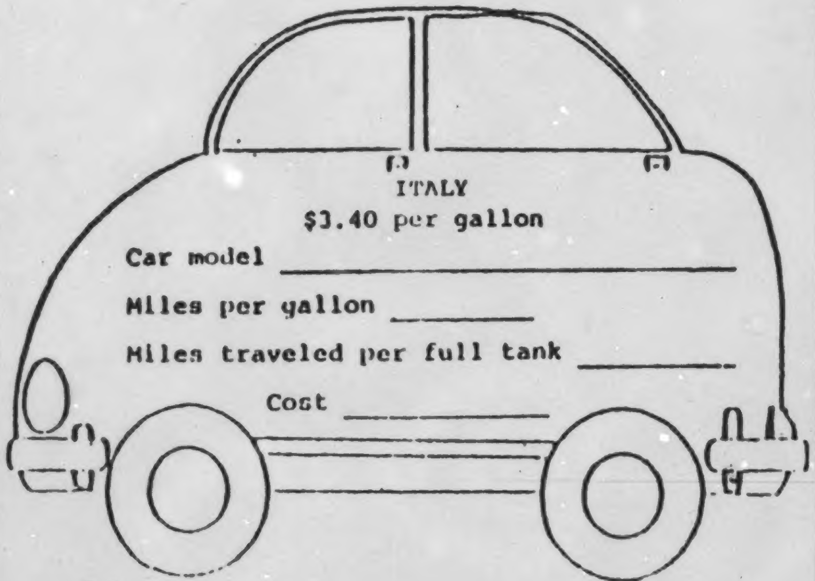
ISRAEL
$3.00 per gallon

Car model ________________

Miles per gallon ________

Miles traveled per full tank ________

Cost ________



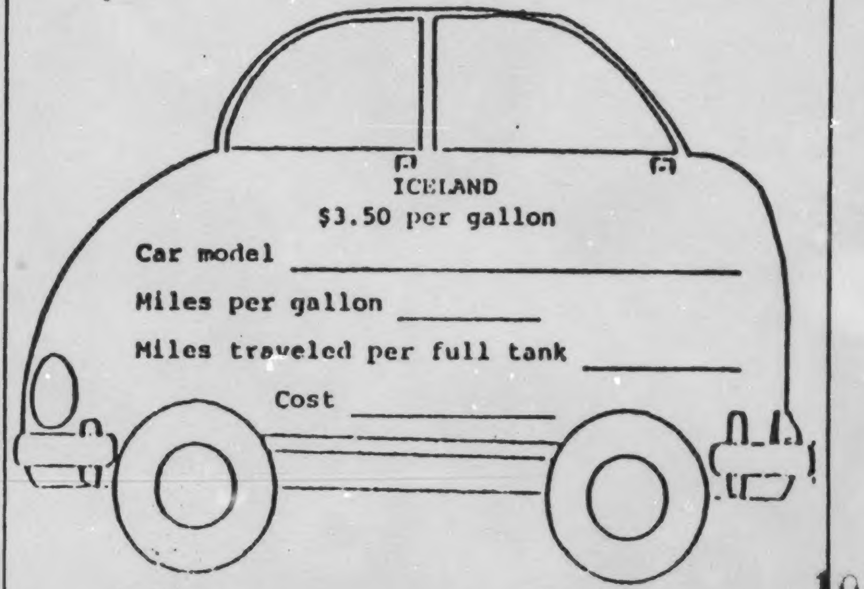
ITALY
$3.40 per gallon

Car model ________________

Miles per gallon ________

Miles traveled per full tank ________

Cost ________



ICELAND
$3.50 per gallon

Car model ________________

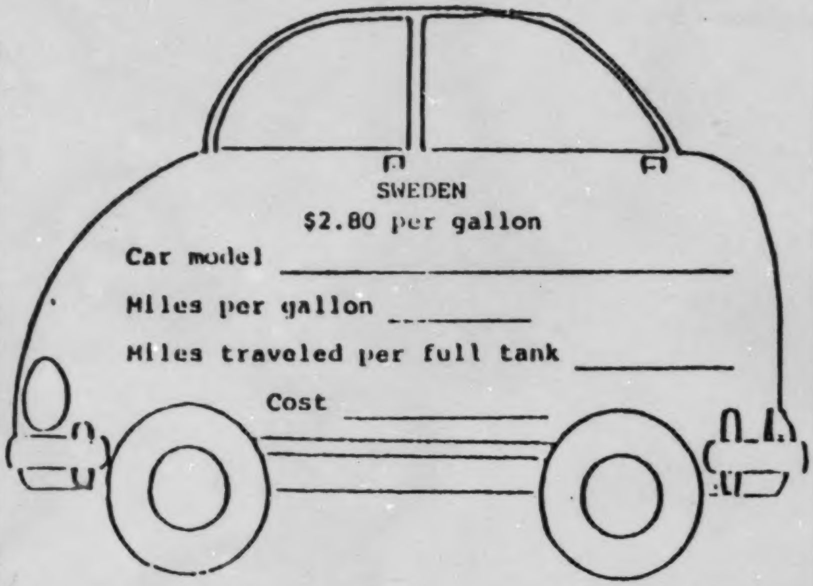
Miles per gallon ________

Miles traveled per full tank ________

Cost ________

Handout A

FILL 'ER UP!



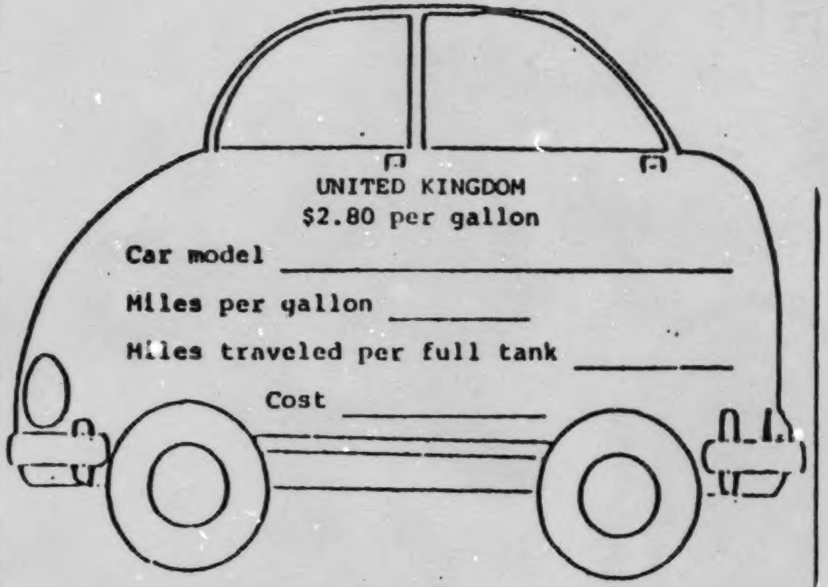
SWEDEN
$2.80 per gallon

Car model ______________________

Miles per gallon ________

Miles traveled per full tank __________

Cost ___________



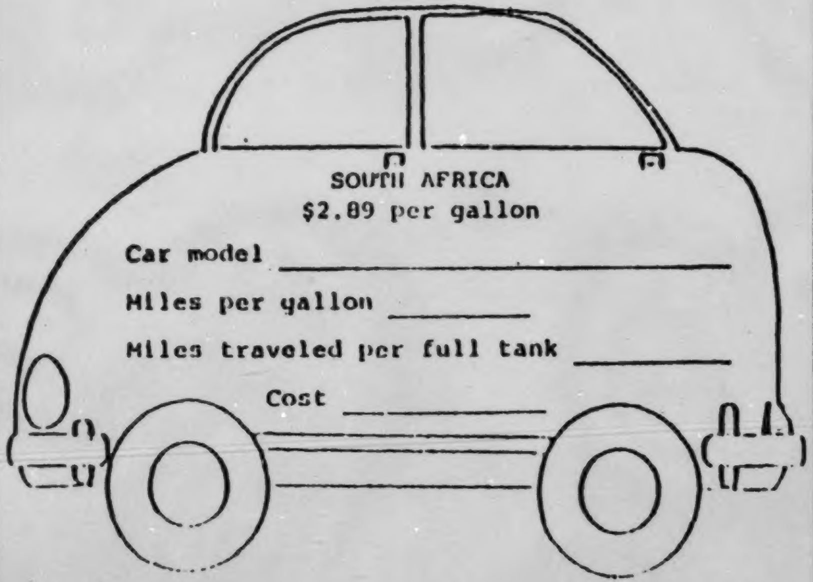
UNITED KINGDOM
$2.80 per gallon

Car model ______________________

Miles per gallon ________

Miles traveled per full tank __________

Cost ___________



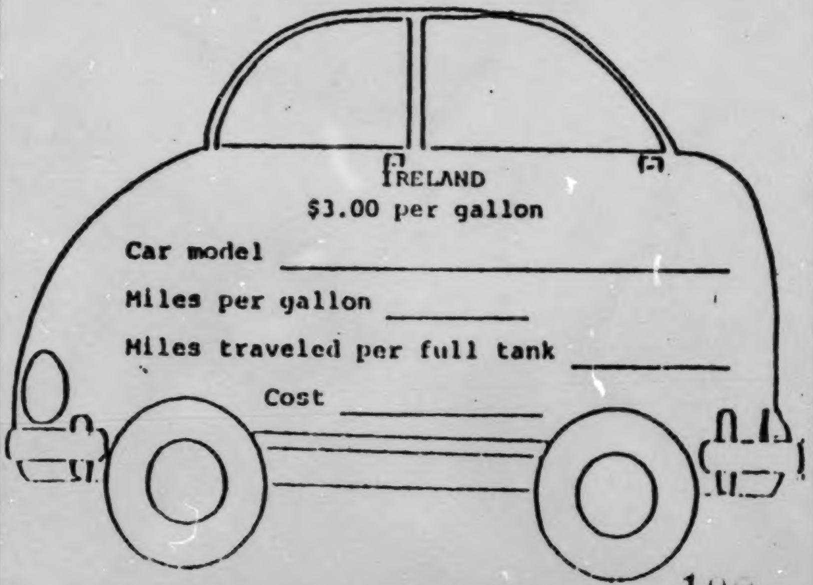
SOUTH AFRICA
$2.89 per gallon

Car model ______________________

Miles per gallon ________

Miles traveled per full tank __________

Cost ___________



IRELAND
$3.00 per gallon

Car model ______________________

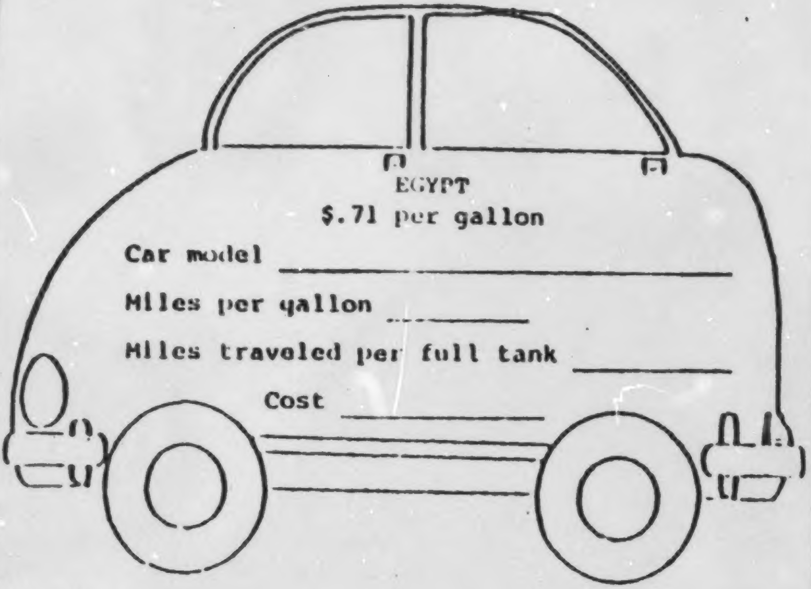
Miles per gallon ________

Miles traveled per full tank __________

Cost ___________

Handout A

FILL 'ER UP!



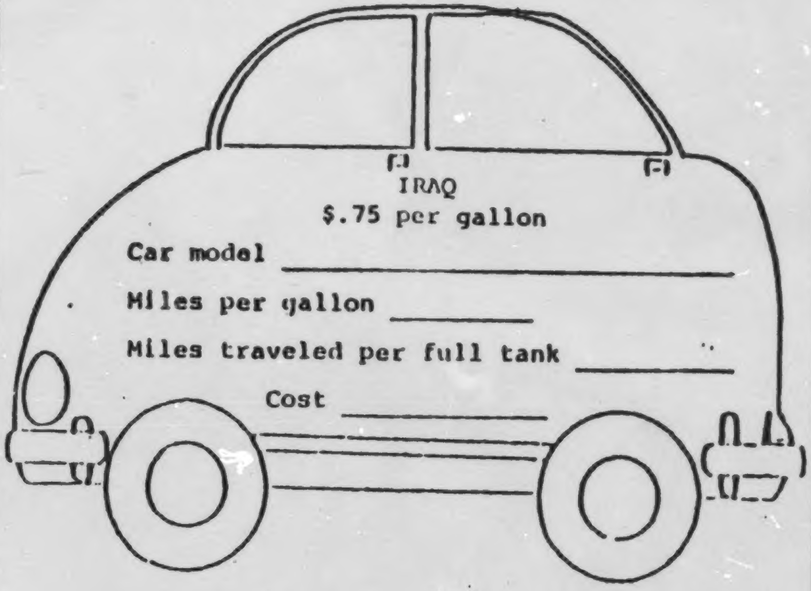
EGYPT
$.71 per gallon

Car model ____________________

Miles per gallon __________

Miles traveled per full tank __________

Cost __________



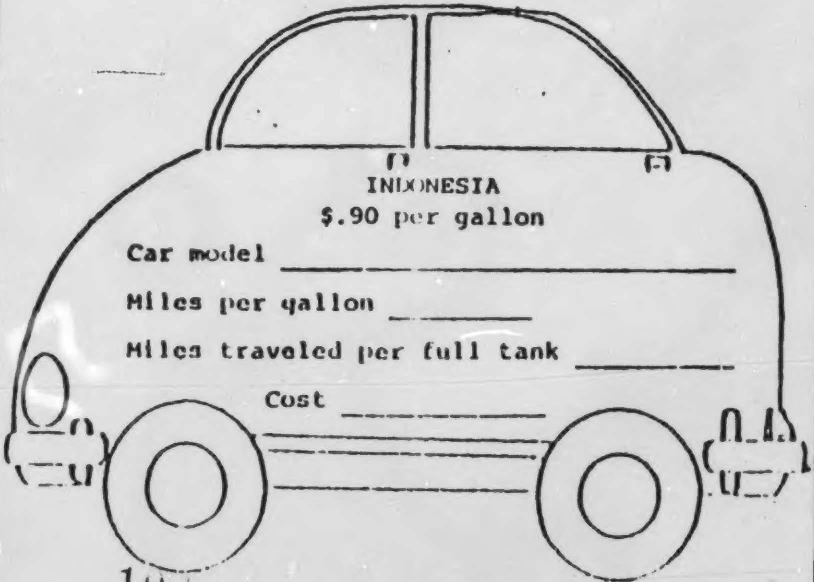
IRAQ
$.75 per gallon

Car model ____________________

Miles per gallon __________

Miles traveled per full tank __________

Cost __________



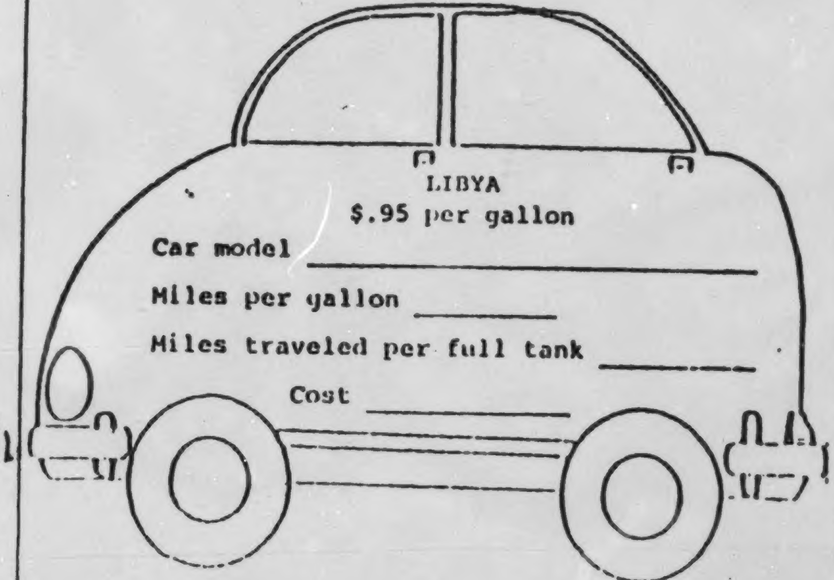
INDONESIA
$.90 per gallon

Car model ____________________

Miles per gallon __________

Miles traveled per full tank __________

Cost __________



LIBYA
$.95 per gallon

Car model ____________________

Miles per gallon __________

Miles traveled per full tank __________

Cost __________

Handout A

FILL 'ER UP!

FRANCE

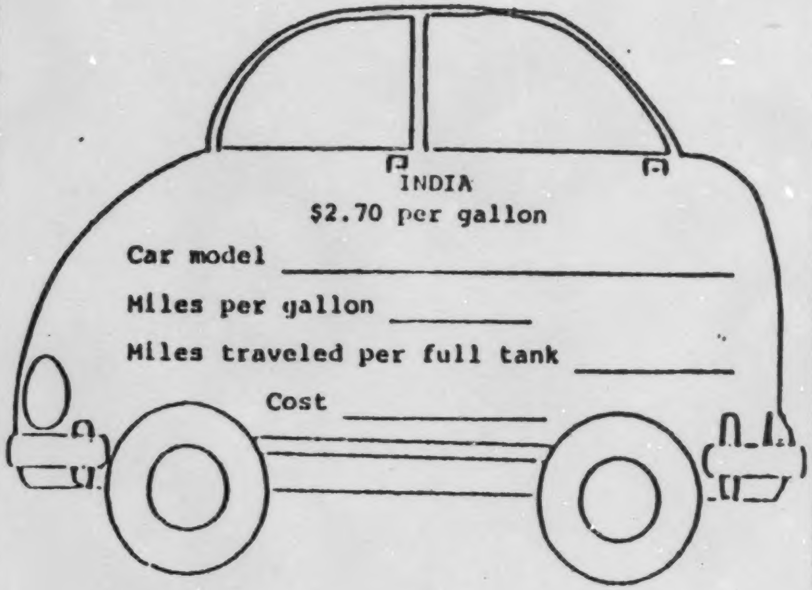
$2.70 per gallon

Car model ______________________

Miles per gallon _______

Miles traveled per full tank ________

Cost __________



INDIA

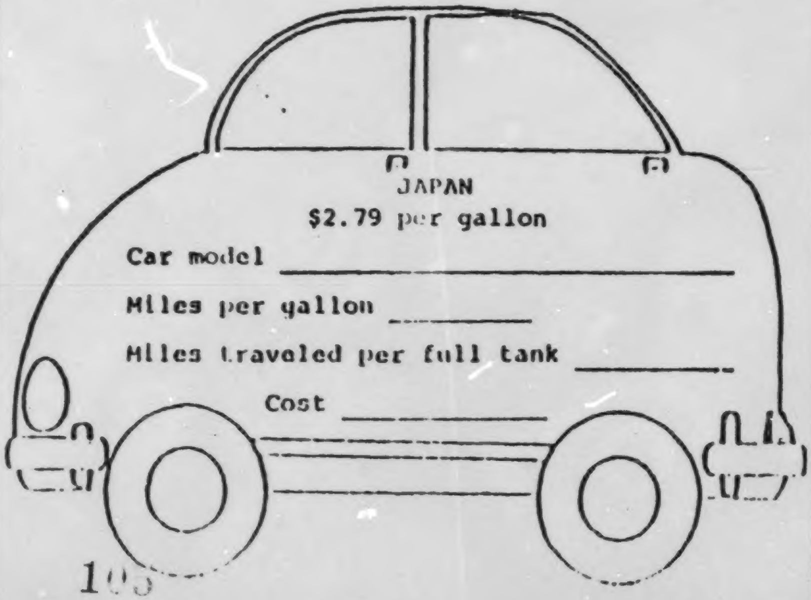
$2.70 per gallon

Car model ______________________

Miles per gallon _______

Miles traveled per full tank ________

Cost __________



JAPAN

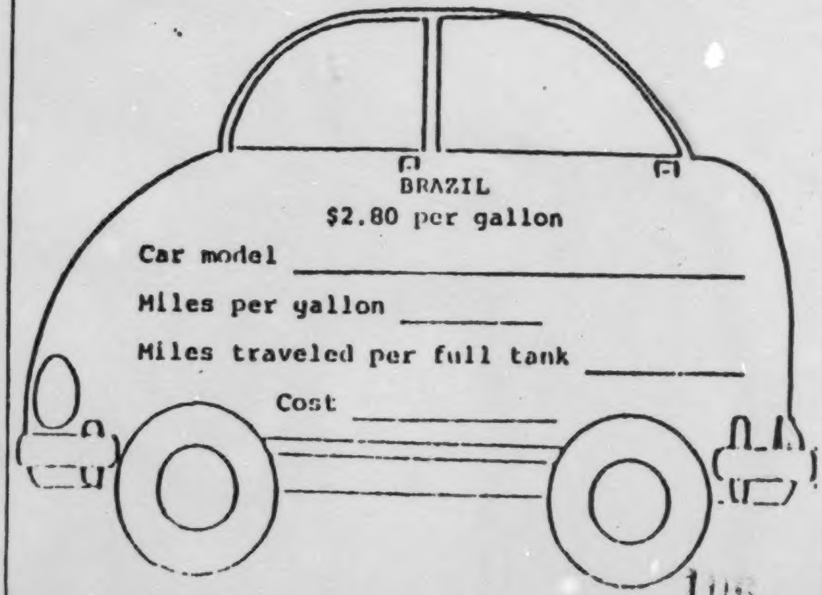
$2.79 per gallon

Car model ______________________

Miles per gallon _______

Miles traveled per full tank ________

Cost __________



BRAZIL

$2.80 per gallon

Car model ______________________

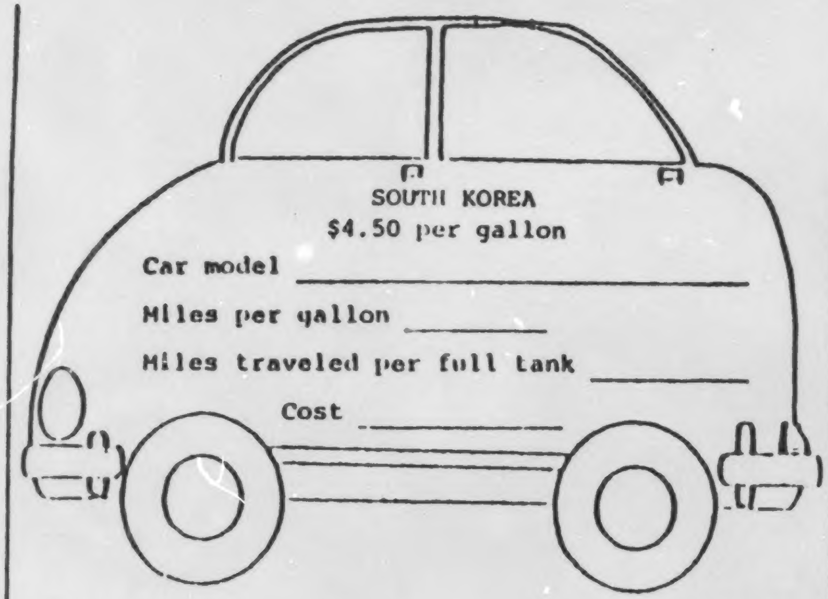
Miles per gallon _______

Miles traveled per full tank ________

Cost __________

Handout A

FILL 'ER UP!



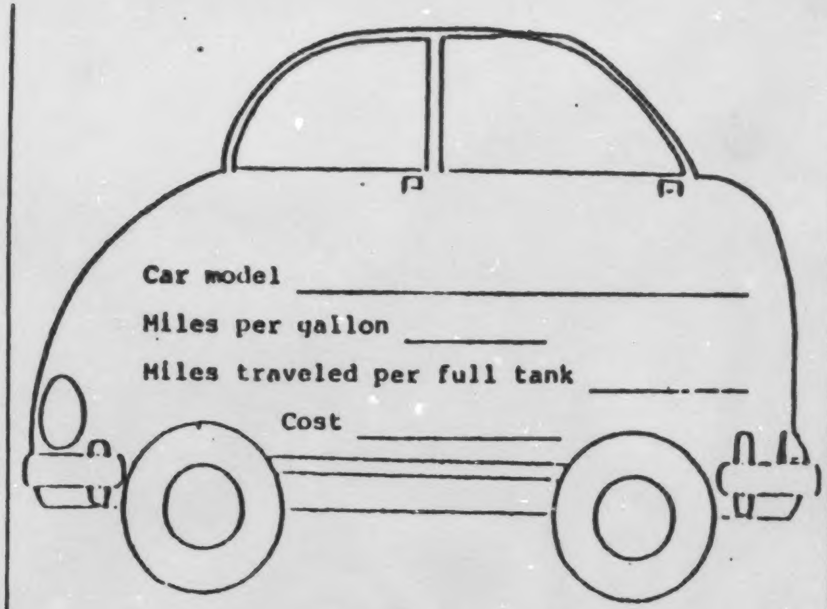
SOUTH KOREA
$4.50 per gallon

Car model ______________________

Miles per gallon ________

Miles traveled per full tank ________

Cost ___________

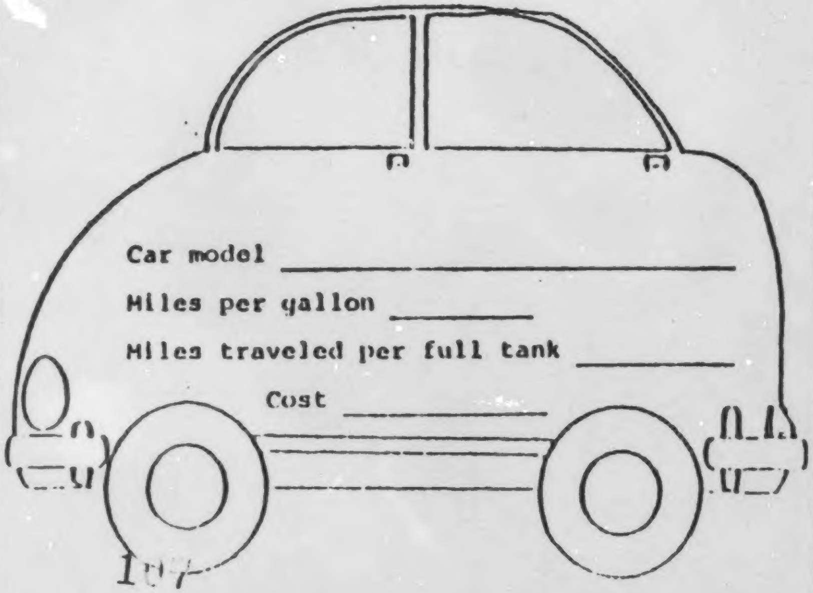


Car model ______________________

Miles per gallon ________

Miles traveled per full tank ________

Cost ___________



Car model ______________________

Miles per gallon ________

Miles traveled per full tank ________

Cost ___________

Car model ______________________

Miles per gallon ________

Miles traveled per full tank ________

Cost ___________

Handout B

FILL 'ER UP WORKSHEET

Directions: Use the information on the car data cards to answer the following questions:

1. Which car can go the farthest on a full tank of gas (ten gallons)? How many miles can it go? ____

2. Which car would go the shortest distance on a full tank of gas? How far could it go? ____

3. Of all the different combinations of cars and countries, which one would allow you to drive 100 miles for the least amount of money?

____

(use the space below for figuring)

Handout C

BUS AND SUBWAY FARES AROUND THE WORLD IN 1981
(in U.S. dollar equivalents)

City	Fare
Cairo, Egypt	$.03
Mexico City, Mexico	.04
Moscow, USSR (Russia)	.07
Istanbul, Turkey	.10
Rome, Italy	.10 bus, .20 subway
Tel Aviv, Israel	.17
Rio de Janeiro, Brazil	.20
London, England	.27 bus, .44 subway
Johannesburg, South Africa	.31
Sydney, Australia	.31
Tokyo, Japan	.52 bus, .40 subway
Frankfurt, West Germany	.62
Paris, France	.75
Boston, USA	.25 bus, .50 subway
New Orleans, USA	.40
Honolulu, USA	.50
Minneapolis, USA	.50
Chicago, USA	.60
Los Angeles, USA	.65
New York City, USA	.75

Source: Geo, June 1981, p. 150. Note: Where fares vary according to distance and time of day, the minimum cost is shown. The complete list in Geo is much longer; for this activity, only fares for cities in the countries mentioned on the first page of the activity were selected.

PURPOSE: To examine various types of transportation in the urban environment.

LEVEL: Junior high school

SUBJECT: Social Studies, Math

CONCEPT: Management is the result of technical and scientific knowledge being applied in a rational direction to achieve a particular objective.

REFERENCE: Coon and Bowman, 1976, pp. 143-145.

MATERIALS: Copies of team assignments.

ACTIVITY:

1. Divide class into four teams and assign each team one of the following studies:

   Team I - Car Transportation

   1. Measure an average car, its width, length and height. How does the size of a car compare to the size of the street, parking space, curb, garage? If you had to design a road what would you do differently?

   2. Interview some people who own cars. Where did they buy it; where do they keep it? How much money do they spend on their cars? Do they like it? Why or why not? List some reasons you think cars are unnecessary. List any city functions that are dependent upon cars. List some reasons that cars are not beneficial.

   3. Talk to a parking lot attendant. How many cars are in the lot? What is the cost to park for five hours, for a day? Compare the cost of parking lot parking, parking meter parking, and riding a bus. Which is cheaper? What are the advantages of each?

   4. Walk to a car dealer. How are the cars sold? Are new or used cars more popular?

   5. Visit a gas station. How has the energy crisis affected automobile transportation? How are repairs made on cars?

   Team II - Bus Transportation

   1. Visit a bus garage. Find out all you can about the size of buses, both inside and outside, how buses differ from cars. What determines bus routes?

   2. Explore a bus stop. Why are they where they are? What are they like?

3. Talk to a bus driver. Why did he or she choose this job? What does he or she like about it? What are some of the problems faced every day?

4. Interview some people waiting for the bus at a bus stop. Where are they going? Do they ride buses frequently? Seldom?

5. Estimate how many people are on at least five buses. Was the bus full? Half full? Almost empty? Where do you think most of the people are going by just looking at the passengers?

Team III - Bicycles

1. Measure a bicycle; how does it compare to the size of a car? Measure a bicycle path, how does it compare to the size of a road?

2. How many different kinds of, not makes of, bicycles can you see? What are the differences and advantages of each?

3. Interview some bicyclers. Why do they ride? What do they like about their bikes? What are some problems for bicyclers?

4. What provisions are made for bicyclers in the urban environment?

5. Visit a bicycle shop. What are common repair or replacement items? How much do bikes cost? Repairs? Accessories?

Team IV - Car Pools

1. Tally how many of their classmates and families are involved in car pools. To school activities? To work?

2. Station the team near a busy intersection during rush hour. Have them count the number of cars that drive by. How many people are in each car? (In cars with several passengers, estimate which are families and which are probably car pools.)

2. Have each group report findings and observations. Discuss which methods use the most/least energy. List advantages and disadvantages of each method. Reflect how daily lives would change if we were suddenly forced to ration gas and had only half the amount available we now have.

DISCUSSION:

1. What kinds of impacts might the decisions each person makes regarding a mode of transportation have on the environment around them?

2. How might these decisions relate to the world environment?

3. What kinds of environmental improvements might occur if people chose to decrease automobile use and increase other modes of transportation?

4. Do the decisions you and your family make regarding types of transportation make a difference to the world environment?

EXTENDING THE ACTIVITY:

You may wish to continue this activity by asking students to check with their parents or older brothers or sisters to find out how many miles per gallon are used by their cars. How much gasoline is used in one week? Calculate the amounts used in one month and one year. Compare different car models and years. Which use the fuel more efficiently?

PURPOSE: To compare a car's energy performance with a bicyclist's energy performance.

LEVEL: Junior-Senior High School

SUBJECT: Mathematics

CONCEPT: "Simpler" forms of transportation may provide several benefits.

REFERENCE: Wahl, Mark, 1974, pp. 100-101.

MATERIALS: Worksheets

ACTIVITY: Ask your students to complete Worksheet.

DISCUSSION:

In small groups or in writing:

1. Compare the answers to questions 2 and 3 on the Worksheet. Draw a conclusion about riding bicycles.
2. With this conclusion in mind, what environmental benefits might there be in shifting from automobiles to bicycles for most short distance transportation?
3. What transportation choices can you, as an individual, make to help save energy?

EXTENDING THE ACTIVITY:

Investigate bicycle use in other countries, including some where daily use is extensive, and compare it to U.S. bicycle use. Draw conclusions about the benefits gained from bicycle use, and discuss what the U.S. might learn from other countries.

Worksheet

Cars use gasoline and people on bikes use food to get the energy to move. Before we can compare a car's performance with a bicyclist's performance, we have to talk about how energy is measured.

ENERGY is usually measured in terms of how much HEAT it will make. We will have to spend some time now learning about units of energy.

The calorie and the joule are two small units of heat (energy).

1 joule = .24 calorie

Which is bigger, a joule or a calorie? ______________________________

About how many joules are there in a calorie? ______________________

Then there are large Calories (with a capital C)

1 Calorie = 100 calories = 4166 joules

A farmer might use up to 4,000 Cal in a hard day's work. How many joules of energy would the farmer use up on such a working day? ______________________

Now, a person who uses of 746 joules every second is working very hard, whereas one who uses of 746 joules in an hour is barely moving. So ... TIME has to be taken into account when we spend energy.

a joule-per-second is a watt
746 watts = 1 horsepower

How many watts is 11 horsepower? ______________________

How many Calories per second is a horsepower? ________________________

(Hint: Give an approximate fraction.)

Calculate the following:

1. A glass of whole cow's milk contains 660 calories of energy. How many joules is this? ___________________________

   If a bicyclist burns up 373 joules per second (i.e., 373 watts or ½ horsepower), how long will a glass of milk allow him or her to pedal?

   ____

2. According to one calculation, a person on a bicycle uses 12.6 calories to travel 1 kilometer (assuming bike + rider = 84 kg). If the cyclist goes 24 km/hr (a comfortable speed) it takes how long to go 1 kilometer? __________ min or __________ sec. Thus, our bicyclist uses 12.6 calories or ______________ joules in ____________sec. This is __________ joules per second; i.e., ________________ watts. Our bicyclist, therefore, is using energy about like burning a ______________watt light bulb.

3. A car, on the other hand, uses 1500 calories to travel 1 kilometer. Assume a speed of 48 km/hr. How long to 1 kilometer? _________________ min or ________________ sec. The car uses 1500 calories or ____________ joules in _______________ sec. This is _______________ joules per second; i.e., _________________ watts. Our car is burning ___________________ 200 watt light bulbs.

SOLID WASTE

PURPOSE: To recycle paper.

LEVEL: Elementary school

SUBJECT: Science, Mathematics, Social Studies

CONCEPT: Resource depletion can be slowed by the development and adoption of recycling methods.

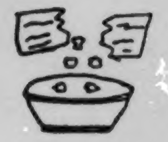
REFERENCE: Bowman and Coon, 1978, pp. 21-22.

MATERIALS:
-bucket or large bowl
-egg beater
-newspaper
-piece of window screen about 4 inches square
-instant starch (this is not necessary, but it will make the paper stronger)
-two or three used pieces of paper

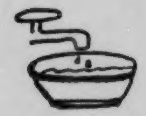
ACTIVITY:

Ask your students to speculate how much paper they use in one day (napkins, lunch bags, school work, paper cups, newspaper, etc.). What would life be like without all of these products? At this time there are enough trees to make all of these paper products, but we might not always have an abundant supply of trees. Used paper products can be made into usable paper. This is called recycling.

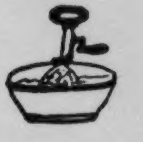
Recycle your own paper.



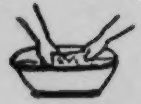
1. Tear the paper into very small pieces. Put the small pieces in the bowl.



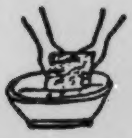
2. Fill the bowl with water. It is best to use warm water, if possible. If you want to use the starch, add two teaspoons of it to the water now.

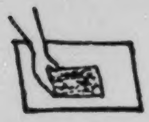


3. Let the paper soak in the water for at least 10 minutes. Then beat it with the egg beater until it becomes soft and mushy. This is called "pulp."



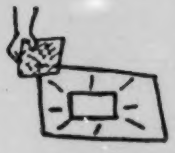
4. Dip the screen into the bowl carefully, tilting it so the edge goes in first. Then lift the screen up flat, letting the pulp cover the screen.





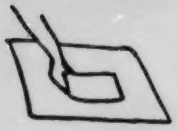
5. Let the water drip back into the bowl.

6. Turn the screen upside down on the newspaper. This has to be done carefully so the pulp doesn't come apart.



7. Slowly and carefully take off the screen. Don't move the pulp! The pulp should stay on the newspaper.

8. Leave the pulp on the newspaper until it dries. When it is dry, you will have recycled paper.



9. Slowly take the recycled paper off the newspaper.

Of course, your recycled paper is much thicker and rougher than recycled paper made in a paper mill. It doesn't look like the recycled paper made commercially. This is because paper mills have all kinds of machines to make the paper smooth and flat.

DISCUSSION:

1. What relationships are there between recycling and the global environment? How might recycling affect the world's forests?
2. Are some countries more affected by the demand for paper than others?
3. In addition to recycling, what actions can be taken to reduce the demand for paper? Are you willing to take some of these actions?

PURPOSE: To explore examples that illustrate how specific products might be reused rather than discarded.

LEVEL: Elementary-Junior high school

SUBJECT: Fine Arts

CONCEPT: The need for recycling is related to society's attitude toward reusing or extending use of materials.

REFERENCE: Kohuth and Marsh, 1974.

MATERIALS: Copies of chart

ACTIVITY:

Using the following chart, ask each student to conduct a home survey and cite examples of "new uses" for "old products."

HOUSEHOLD RUMMAGE "RECYCLING"			
PRODUCT	OLD USE	NEW USE	ENVIRONMENTAL BENEFIT
1. Cracked coffee mug	Beverage container	Pencil holder	No solid waste
2.			
3.			
4.			
5.			
6.			
7.			

DISCUSSION:

1. From the home survey, what can you conclude about the habits of the class members' families with regard to extending the use of products in the home?

2. What are some of the environmental values of extending the use of various products?

3. What are some of the environmental problems created when people choose not to reuse materials?

4. Are countries around the world affected equally by the degree of reuse practiced in your community? Why or why not? In what ways are other countries affected by reuse practices?

NOTE: "Hints from Heloise," King Features 235 E. 45th St., New York, NY 10017, is a good source of ideas for this activity.

Students might enjoy conducting a "Rummage Fair" or sale, with their creations on display (seek parental assistance).

PURPOSE: To show the amount of material wasted in excess packaging.

LEVEL: Elementary-Junior high school.

SUBJECT: Social Studies.

CONCEPT: Consumption practices are constantly being expanded by our ability to produce and create wants and markets, which affect the rate of resource use.

REFERENCE: Bowman and Coon, 1978, p. 33.

MATERIALS: Packing examples (in lieu of a field trip to a grocery store).

ACTIVITY:

If possible, take the class or a committee of students to a grocery store and have the students find examples of various types of excess packaging and try to explain the purpose of such packaging. If a field trip to the store is not possible, the teacher and students could bring various packaging examples to class.

Things to notice about the packaging include:

1. What are the purposes of packaging items? Which purposes are essential (e.g., protect item, prevent spoilage) and which are non-essential (e.g., attractive colors, make item look larger)?

2. Does the color of the package make any difference? Did you ever buy a product because you liked the way it was packaged?

3. How is the packaging of an item used in advertising the item, especially television advertisements?

4. Are all items packaged? Some items won't spoil and are easy to handle without packaging; examples are spools of thread, pens, screwdrivers, hammers, etc. Yet sometimes these items are also found in "bubble packs." What are the advantages of "bubble packs?"

5. Some items are packaged in small containers for convenience. Compare the amount of cardboard packaging in a variety pack of cereal with a single large box of cereal that holds the same amount. Open each variety pack and measure the total area of cardboard used in the single box. Which was less expensive? What are the advantages and disadvantages of the "variety pack?"

6. What variety of resources are used for packaging?

DISCUSSION:

1. Investigate, if possible, methods of packaging similar items in other countries? (Suggestion: contact people who have travelled in other countries.)

2. What are some of the impacts of excess packaging on the world environment?

3. In terms of their environmental impacts, are the materials used usually the wisest choices? In what ways can choices be improved?

4. What options are available to consumers to help minimize the environmental effects of excess packaging? Name some examples of environmentally wise alternatives.

PURPOSE: To explore the possibility of establishing a recycling collection center on school grounds.

LEVEL: Elementary-junior high school.

SUBJECT: Social Studies, Mathematics.

CONCEPT: Recycling responsibilities should be shared by individuals, businesses and industries, special interest groups, and all levels of government and education.

REFERENCE: Bowman and Coon, 1978, p. 46.

The accumulation of waste paper, particularly newsprint, is an endless process in many homes. Hence the occasional paper drive is an inadequate solution to the problem of getting paper routinely into the recycling stream. Aluminum cans, which require enormous amounts of electrical energy to make, are also easily collected and sold. Glass containers are considerably more difficult to handle, and probably should not be collected and handled by children in a school collection center.

As neighborhood centers, elementary and/or junior high schools might serve as logical sites for collecting newspapers and aluminum cans. Under adult supervision students could do most of the physical work involved in bundling and tying the paper and in compacting the aluminum cans. With careful organization no student would spend excessive amounts of time on this project, which could serve as a money raising effort while it contributes toward the saving of natural resources and energy.

ACTIVITY:

Hold up several aluminum cans and ask the class--what should I do with these empty cans? Do they have to become garbage? Discuss that garbage has to be put somewhere and we are running out of places to dump it. Since each person produces about five pounds of garbage per day we could someday all have to live on garbage dumps. One way to help our environment is to reuse or recycle products rather than toss them away as useless. Aluminum is worth money (10¢ a pound) when it is recycled. Since there is only a limited supply of aluminum ore in the earth, collecting aluminum cans for recycling is one way students can share in helping the environment.

Discuss with classes the idea of establishing and maintaining a collection center on the school grounds. Would students be willing to do the physical labor involved? Could a place be found to store the collected materials safely? Is a market for waste paper and aluminum guaranteed? How can necessary transportation be secured? What do parents think about the idea? What does the school's administration think? Could/should the PTA be involved somehow? How about local youth or religious groups?

If a positive response from all parties concerned can be secured, develop and operate the collection center for at least six months. Then evaluate the operation to determine if it should be continued indefinitely.

DISCUSSION:

1. In what ways does recycling help the environment? Be specific.
2. What are some of the problems in maintaining a recycling operation? How can these problems be overcome?
3. What prevents people from recycling newspaper, glass, and aluminum on a regular basis?
4. What environmental benefits might there be for your community with the establishment of an easily accessible recycling operation?
5. How might the world environment be affected by your recycling efforts? What might be done to build upon these benefits?

PURPOSE: To investigate the use of plastic for household items and the environmental problems associated with discarding plastic materials.

LEVEL: Junior high school.

SUBJECT: Science, Social Studies, Language Arts.

CONCEPT: Individual citizens should be stimulated to become well informed about recycling developments, problems, management procedures, and ecological principles.

REFERENCE: Schatz and Schatz, 1971.

ACTIVITY:

Save all the plastic your family discards in a one or two week period.

Calculate the average weight of plastic that each member of your family discards in a year. At that rate, what is the total weight of plastic that is discarded by all the people in your community in a year?

What particular problems are encountered in disposing of plastic by composting it or burying it in a landfill area?

Burn three or four small, thin pieces of different kinds of plastic. Do your think that incineration is a good way of getting rid of used plastic? Why?

What do you think can be done about the plastic pollution problem?

List all the things you use that are made of plastic.

How many of these items do you really need? Would you be willing to do without them?

For which items could you use other things not made of plastic?

DISCUSSION:

1. What environmentally and politically significant world resource is tied to the production and use of plastic? (How is plastic made?) Is the amount of plastic used by one person important to the world environment? Why or why not?

2. From the list of items you use that are made of plastic, design a written contract stating actions that you agree to take in order to reduce your use of plastic and thus improve the quality of the world environment. Put the contract into practice for one month. After that time, evaluate your performance and decide whether or not you will continue with your contract on a voluntary basis. Why or why not?

PURPOSE: To survey student attitudes toward purchasing recycled paper.

LEVEL: Junior high school, Senior high school.

SUBJECT: Social Studies.

CONCEPT: Economic efficiency does not always result in conservation of a natural resource.

REFERENCE: Bowman and Coon, 1978, pp. 71-72.

MATERIALS: Handout (Conserving Natural Resources).

ACTIVITY: Pose the following question to your class:

What Would You Do?[*]

You want to buy some recycled writing paper. A store near you has the recycled paper next to regular writing paper. The recycled paper costs more than the regular paper. Which do you buy?

Solicit each student's response.

Now, make available to each student the following information.

Conserving Natural Resources

"Everyone wants a better environment. But it remains for each one of us to make the commitment that can make it possible. Recycling is the environmental commitment in terms of conserving natural resources as well as reducing solid waste.

"Paper recycling is the alternative to the increased use of trees...trees which, in spite of improved growing and harvesting techniques, can no longer be counted on to meet the spiraling paper and lumber demands of our soaring economy. There have been repeated warnings about our forest limitations in the face of an annual paper production that will soon be 50% above present levels.

---

[*] From Recycled Paper Products, National Association of Secondary Material Industries, Inc., 330 Madison Avenue, New York, NY 10017.

"Paper recycling conserves hundreds of millions of trees every year, stretching our timber reserves. It enables us to move from use-and-discard to use-and-reuse. It doubles and redoubles the mileage we get from our wood resources.

"In addition, the U.S. Environmental Protection Agency reports that recycling requires less energy than virgin material production and results in less air and water pollution.

"There certainly are many pluses--economic and environmental--to paper recycling."

Economic Value

"Recycling waste paper can add hundreds of millions of dollars to our national economy--and reduce our solid waste costs by a like amount. Each additional ton of waste paper we recycle turns an environmental liability into an economic asset. We presently do not recycle 48 million tons of paper each year.

"It has been estimated that about 35 million tons of that amount could be recycled. And if we don't recycle more, the problem will get worse; in a few years there will be almost 50% more waste to contend with.

"It all depends on economics. Waste paper will be recovered for recycling, instead of dumped or burned, only when there is a paper mill customer for it. Therefore, as the consumer demand for recycled paper products grows, so will the economic value of waste paper presently being discarded grow.

"Paper stock processors also are seeking to expand opportunities for exporting recycled materials surplus to our domestic needs. "Have not" nations abroad represent growing markets for recycled paper, and that gives the U.S. a valuable asset in terms of increasing exports and improving our international trade positions.

"Paper recycling seems like an almost miraculous rebirth of valuable raw materials and products. The potential of recycling is limited only by our own willingness to give recycled paper more economic value through consumer preference."

After students have read and discussed this information, ask each again the "What Would You Do?" question. Did responses change as a result of new information? Point out the problems associated with making the American public recycling-conscious. How would your students go about changing attitudes of the general public?

DISCUSSION:

1. Point out the problems associated with making the American public recycling-conscious. What are are some of the reasons that recycling is not more widely practiced? How would your students go about changing attitudes of the general public?

2. How does the awareness of the American public compare to that of other countries? Research the recycling practices prominent in other countries. What might the United States learn from other nations?

VARIATION:

This activity could be enriched by asking students to declare their answer to the question by standing on one side of the room or the other. The discussion could then begin by pairing (or grouping) students that disagree and asking them to share their views with one another. This would be most effective during the first round of the activity as the written materials are likely to sway many students' opinions.

PURPOSE: To examine the value (use) of American trash in another social setting.

LEVEL: Junior-Senior high school.

SUBJECT: Social Studies.

CONCEPT: The values held by a society determine what are resources and their economic worth.

REFERENCE: Bowman and Coon, 1978, p. 90.

ACTIVITY:

Develop, with input from class students, on the chalkboard a list of materials typically thrown away as trash by Americans. The list would obviously include such items as paper, cardboard, soft drink cans, cans used in processing fruit and vegetables, glass bottles, plastic containers, pieces of wood, scraps of iron, pieces of wire, and many, many others.

After developing the list ask students (working in groups of three or four) to assume that they are a family of destitute beggars in a very poor village of some under-developed country. Their total family income for the year is less than $50.00. They live in a hovel that provides inadequate shelter from cold, wind, and rain. The dwelling has a dirt floor. They lack fuel for cooking. Places to store water and grain are inadequate.

Ask the group to suggest how the items previously listed (paper, cans, etc.) could be used in or near the homes of these poverty-stricken people. Encourage creative ideas such as cutting up cans to make roofing material, using newspapers and cardboard as insulating material, and so forth.

Ask groups to report their ideas to the class.

DISCUSSION:

In final discussion make a strong point of the fact that trash disposal is a problem unique to affluent societies such as ours. Recycling or reuse of materials is a matter of survival for millions of destitute people around the world. Are such conditions necessary before people take the idea of recycling seriously? What alternative pressures are possible? What actions might be taken by students in the United States to help people such as those role-played in this activity? (Ideas should be limited to resource-use related actions.)

PURPOSE: To develop the realization that humans are rapidly using up the non-renewable resources found on earth.

LEVEL: Junior-Senior high school.

SUBJECT: Social Studies.

CONCEPT: Most resources are vulnerable to depletion in quantity, quality, or both.

REFERENCE: Bowman and Coon, 1978, pp. 93-94.

ACTIVITY:

The table below lists some of the irreplaceable natural resources which are vital to modern industry. The United States has 6 percent of the world's people and uses between 40 and 50 percent of the world's irreplaceable natural resources. However, these facts do not become significant or impressive as long as we have a large supply of those resources. The questions which we must consider are: Do we have a limited supply of these irreplaceable resources? If so, what are our expectations for the future? The following table does not provide an answer to either of these questions, but it is an aid in understanding the existing situation. Please keep in mind all of the variables which are not taken into account such as presently undiscovered reserves, ore which is presently considered marginal, recycling, etc.

Resource	Static Reserve Index In Years	Exponential Reserve Index In Years At 2.5% Increase	Current Rate of Increase (%)
Aluminum	175	67	8.0
Chromium	560	108	4.0
Cobalt	155	63	4.6
Copper	40	28	3.3
Gold	17	14	2.4
Iron	400	98	3.8
Lead	15	13	2.0
Manganese	180	68	4.5
Mercury	13	13	3.0
Molybdenum	100	51	5.0
Nickel	140	60	8.7
Platinum	20	17	8.5
Silver	20	17	6.0
Tin	25	19	6.0
Tungsten	40	28	5.0
Zinc	18	15	6.2
Coal	900	127	3.6
Natural gas	35	25	6.6
Petroleum	70	41	6.9
Uranium	66	40	6.0

STATIC RESERVE INDEX gives the number of years our known world reserves of that resource will last if we continue consuming it as we do today.

EXPONENTIAL RESERVE INDEX shows how long the reserves will last if the usage rate increases by 2.5 percent per year.

CURRENT RATE OF INCREASE shows, for comparison, what the ACTUAL growth rate in world consumption for each resource is today.

DISCUSSION:

In considering the table, have the students list those resources which are being used at the fastest rate. What are some ways in which these materials are being used? Can recycling play a role in reducing the loss of these resources? Invite a speaker from a local recycling center to discuss with the class some of the problems involved in processing material and reselling it.

What actions could the students take to increase the amount of recycling in their community?

FOLLOW-UP:

Use this activity to lead into a class project promoting recycling throughout the community (i.e., start a recycling operation, or assist at an existing operation).

PURPOSE: To become aware of the determinants of the types of materials chosen for packaging consumer goods.

LEVEL: Junior-Senior high school.

SUBJECT: Social Studies, Language Arts, Fine Arts.

CONCEPT: Individual citizens should be stimulated to become well informed about recycling developments, problems, management procedures, and ecological principles.

REFERENCE: Giebelhausen, *et al*., 1973.

BACKGROUND:

"Modern products are designed to contain and protect the form and quality of a product and to facilitate its timely and efficient movement through trade channels. And, let it be added in the same breath, to attract and please customers."[1] The consumer does play an important role in determining the types of materials used in packaging because it is he or she that has to be persuaded to purchase the product. If the consumer if not attracted by the product or the package that contains the product, it is likely that the consumer will pass it by. Industries have to keep the wishes and likes of consumers foremost in mind. Therefore, "to utility have been added color, art, design, imagination, and convenience. Plain bottles have become attractive decanters. Boxes that contain pancake and biscuit flour carry recipes. Cheese comes in gay tumblers. Bags that protect carrots can be put to a dozen uses in a kitchen. Tins for cake and candy are almost like jewel boxes. But with all that, the packages have to be cheap enough to permit a commercially feasible method of distribution, and they have to provide some benefits to growers, distributors and users of the product."[2]

"A processor considers a number of factors in selecting materials and types of containers. Generally, he tries to select a package that most economically meets such basic requirements as protection and preservation of quality, convenience, preferred sizes, and attractiveness."[3] All of these characteristics relate directly to the consumer and to his preferences.

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1. United States Department of Agriculture, *Marketing--the Yearbook of Agriculture--1954*. Washington: United States Government Printing Office, page 132.
2. Ibid, p. 132.
3. Ibid, p. 135.

Using all characteristics mentioned, the processor and packager work together to create a packaged product that meets all needs. "For example, not long ago all red meats were packaged for the customer after he or she had made her selection from the meat counter. But, in order to adapt red meats to self-service merchandising, the meat had to be cut, weighed, and wrapped in some type of package before being placed on retail display--a development commonly referred to as prepackaging. We like to see the particular cut of meat that we buy, not generally feasible until the development of satisfactory transparent films. Visibility was important, but other packaging problems also arose because of the characteristic of red meat. It generally is bright red immediately upon being cut and becomes dark red soon after being exposed to the oxygen in the air. The extent of the oxidation process and subsequent darkening of the meat, after a long period of exposure to the air, is related to the amount of oxygen to which the meat is exposed. A special type of cellophane had to be developed which would permit enough - but not too much - oxygen to penetrate the package."[4] In this example, it is evident that much cooperative thinking must be done to accomplish the task of producing a product that is attractive, convenient, and maintains good quality for the customer.

Shapes and sizes of the packages must also be acceptable to the consumer and often this is a matter of trial and error by the packager. "For example, in a test period of 3 weeks, consumers in three cities showed a preference for apples in 3 or 4 pound bags over similar apples in 5 pound bags. The design of the package is important as well - square milk bottles require one-third less space than round bottles. Short ketchup bottles tip over less easily than tall bottles. A package should not fall apart on the way home. It has to be easy to open. Potato packagers have found out that the customer does not want to unfasten the wire tie with a pair of pliers. Consumers complain when they cannot close a cellophane bag after using part of the contents."[5] All these points illustrate how the consumer must be considered when designing all packages.

The average family spends at least $200.00 of its yearly budget just for the package, which is eventually thrown away.

ACTIVITY:

Discuss with your class the types of packaging materials that are recyclable, such as: glass, metal cans, paper packages, cardboard, etc.

The following types of packaging cannot be recycled: plastics, plastic products such as styrofoam, and cellophane. (Plastic-coated paper packages can be recycled if the plastic is removed; however, the process is so expensive that they usually are not recycled.)

Ask your students to bring from home a package that is recyclable and one that is not. Discuss the characteristics of their packages in terms of:

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4. Ibid, p. 133.
5. Ibid, p. 134.

1. The aesthetics of the package (attractiveness, good lines, display of the product).

2. Ecological soundness (biodegradable, use of minimum resources to produce wasting of resources).

3. Appropriate packaging for the product (protect and preserve the quality of the product, preferred sizes, convenience).

4. Advertisement (psychology of packaging: is it advertised honestly? Does it make the product appealing to all?).

Now, choose a product and secure 4 or 5 packages that contain the product. For example, choose a product such as green beans and bring to class green beans in a can, in a jar, in frozen paper packages, frozen in a plastic bag, etc. Display the packages where all can see them well. Ask the students to choose a package which they think the majority of the class would purchase. Tell them to base their answer on the packaging type. Also, ask them why they chose the package.

Divide your class into small groups. Assign each group the task of choosing a product and designing the packaging materials that suits all aspects of correct packaging, also keeping in mind the ecological soundness of the package. Have each group develop an advertising campaign for their product. They may decide to write a radio or TV commercial to sell their product.

DISCUSSION:

1. Why are current packaging techniques employed? Are they effective?

2. How does packaging design relate to resource use and depletion?

3. What considerations are important in choosing between products if an individual is to minimize the environmental impacts of packaging?

4. How might these choices impact people in resource-rich countries? In resource-poor countries?

PURPOSE: To examine contrasting approaches to recycling.

LEVEL: Senior high school.

SUBJECT: Social Studies.

CONCEPT: Social values and mores influence personal conservation behavior.

REFERENCE: Bowman and Coon, 1978, p. 116.

In recent years several cities have built huge highly mechanized plants to sort the garbage and trash collected by their sanitation departments. The plants are engineered to separate out components such as steel, aluminum and glass, with the intention of burning the combustible remainder, consisting of paper, plastics, food scraps and other materials to produce energy for making electricity. Such plants, often costing as much as 100 million dollars, are built with public tax funds. Once such a plant is built, the city is "locked in" for many years into a single specific garbage disposal system. And the system offers some, but limited, opportunities for recycling.

It is argued by some ecologists that a huge, centralized, complex system such as that suggested above is energy wasteful and unnecessary. Used newspapers ought to be recycled into newsprint rather than burned. Grass clippings and leaves from the city's homeowners ought to be recycled through composting into fertilizer rather than burned to get the very small amount of heat such materials provide. With very little use of energy, homeowners can separate aluminum from steel cans, and separate glass from other garbage. Some advocates of recycling believe that cities should work much harder to develop garbage and trash collecting systems that will make homeowners active participants in recycling efforts. More emphasis, they say, should be placed on what individuals (or families) can do and less emphasis placed on big, expensive, technical solutions to the problem of obtaining wealth from the waste thrown away by American consumers.

ACTIVITY:

Present to the class, in general outline, the two contrasting approaches cited above. Ask several students to research the advantages and present the strongest case they can for the huge garbage sorting-burning plant. Ask an equal number of students to do comparable research and presentation for the alternative approach.

In the research, include an investigation into the approaches used by cities throughout the world. (In particular, many European cities have extensive recycling systems in operation.)

Select five-seven students to serve as a "city council" that is being asked to approve a bond issue to fund a proposed huge plant. Advocates of the contrasting positions should "present their case" to the council and respond to questions that might arise.

Finally, ask the council members to vote for or against the 100 million dollar bond issue on the basis of arguments presented and/or their own convictions.

DISCUSSION:

Does the entire class agree with the council's decision?

Did the information gathered on recycling programs in foreign cities provide any unusual perspectives or particularly helpful material? What does this say about the possibility of learning from other countries?

Which alternative might be better for the world environment? Is this the same choice made by the city council? Why or why not?

PURPOSE: To help learners gain some real idea of use of at least one resource in the community and its economic and land use implications. To given learners an opportunity to exercise basic math skills.

LEVEL: Junior high school

SUBJECT: Math

CONCEPT: The advantages of recycling paper can be quantified in several ways.

REFERENCE: Roth and Lockwood, 1979, pp. 103-104.

MATERIALS: Fact sheets--which should contain the following statements:

1. There are 52 weeks in the year.
2. It takes about 30 years for a pine seedling to reach pulpwood size in prime pulpwood country.
3. One acre of land can grow about 500 trees.
4. The (name of your local paper) generally weighs about _____ ounces. Its Sunday edition weighs _____ ounces.
5. It takes about 17 trees to make one ton of newsprint.
6. The current price for recycled paper in our area is _____ per pound.

ACTIVITY:

1. Count the newspapers used in the home for one week. Using the weight of an average newspaper, determine the weight of the newspapers each family uses in a year.

2. Have the group share their findings and determine how much newspaper is used by all the families of the group in a year. What is the average use per family per year?

3. Multiply the figure found in the last question by the number of families in your town (see Town Report or inquire of local officials) to determine approximate newspaper consumption in the town or city.

4. Using the information gathered and the fact sheet, work out answers to the following questions:

   . Approximately how many trees were used by the group's families to meet their newspaper demand this year?

   . How many for the town or city's needs?

- How many acres does it take to grow the trees needed for these newspapers?
- How long did it take to grow them?
- How long before there will be replacements for these trees?

5. Have the learners list what happens to old newspapers in their homes. What happens to the bulk of papers?
   - If all the used newspapers were collected for recycling, how much would it be worth?
   - How would this affect the amount of land needed for producing paper pulp?

6. Find out who in your community recycles old newspaper. Interview the people in charge. How much paper do they collect each year? Based on your figures, what percent of local paper gets recycled? Can you figure ways to get more people to recycle their newspapers? If more people recycle their paper, what happens to the price per pound (or ton) that the recycler will receive?

DISCUSSION:

1. According to the conclusions drawn from the information provided on the fact sheets, is recycling economically efficient? Should it be promoted on this basis?
2. For what other reasons might recycling be promoted?
3. How might increased recycling affect the world economy? The world environment?

CHEMICALS IN THE ENVIRONMENT

PURPOSE: To compare the impacts of natural and factory-made fertilizers.

LEVEL: Junior high school

SUBJECT: Social Studies, Science

CONCEPTS: Factory fertilizer is a stronger kind of fertilizer than natural fertilizers, but has additional environmental consequences.

REFERENCE: Adapted from Parker, _et al_., 1981, pp. 84-85.

MATERIALS: Handout (Mr. Moyo and Mr. Gumisa)

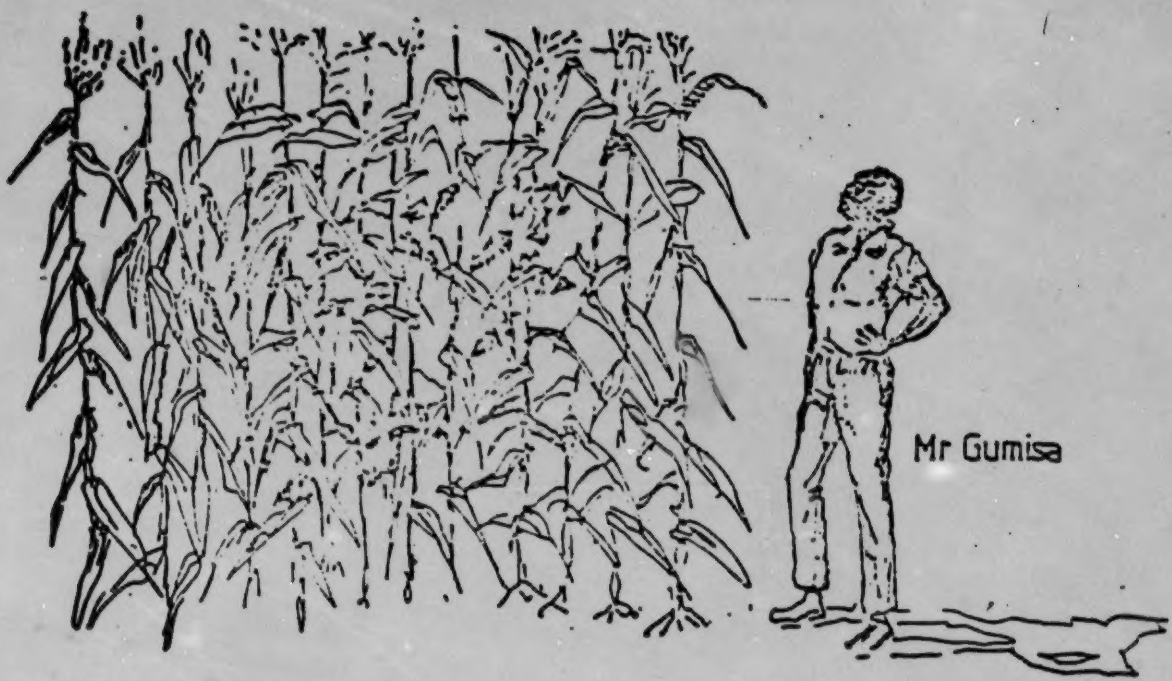
ACTIVITY:

1. In small groups, distribute copies of the handout and answer the question posed.

DISCUSSION:

In small groups or as a class:

1. Based on the experience and knowledge of the United States, what information might a team of U.S. agricultural experts be able to offer the Zimbabwe farmers regarding the use of chemical fertilizers?
2. What are some of the environmental impacts of both natural and chemical fertilizers? Which are the more damaging to the environment?
3. When are the trade-offs between efficiency and environmental effects of factory-made fertilizers significant?
4. How do these issues apply to your own homes? What do your findings say about the use of fertilizers on your gardens at home? On your lawns? Is it wise to use chemical fertilizers to keep your lawn green?



Meet Mr. Moyo and Mr. Gumisa. Both are farmers at Gutu in Zimbabwe. Their farms are side by side.

Mr. Moyo is complaining to his friend about his maize plants. They have not grown as well as Mr. Gumisa's maize plants. Yet, rainfall was the same. It is not as though the weather conditions on the two farms were different.

Mr. Moyo says he ploughed his land just as did Mr. Gumisa. In fact they hired the same tractor to pull the plough.

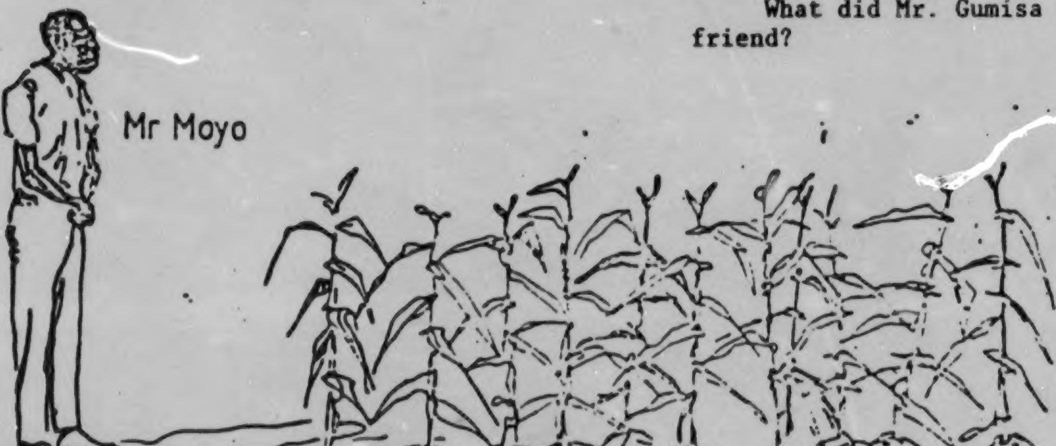
Mr. Moyo says he decided to use only natural fertiliser on his land. He collected all the cattle manure from their kraal and mixed it with soil from an anthill and compost from his compost heap. "It was hard work, too," says Mr. Moyo.

Mr. Gumisa knows that was a good idea, for indeed, natural fertiliser is very good for soil. He wonders, though, if Mr. Moyo had enough natural fertiliser for his five hectares of maize? He knows that if one uses natural fertiliser then a great deal is needed.

The two farmers each have five cattle. Mr. Gumisa used the manure from his cattle and compost for fertilising his wife's vegetables and the groundnuts she was growing. For his five hectares of maize he bought fertiliser.

Finally, Mr. Gumisa decided he must invite Mr. Moyo, whom he liked so much, to his home and give him some beer. He would then try to explain to him why buying factory-made fertiliser has many advantages.

What did Mr. Gumisa say to his friend?



PURPOSE: To note the variety of chemicals commonly used in the household and recognize that some must be used with care.

LEVEL: Junior high school

SUBJECT: Science, Social Studies

CONCEPT: Increasing human populations, rising levels of living, and the resultant demands from greater industrial and agricultural productivity promote increasing environmental contamination.

REFERENCE: Based on Grooms, 1972, and an activity on the effects of household chemicals designed by University of Michigan School of Natural Resources students.

ACTIVITY:

1. Ask participants to conduct a survey in their own homes to:
   - a. List products commonly used in the household that contain chemicals;
   - b. List the major chemical ingredients of the products;
   - c. Note any cautions or poison signs on the containers;
   - d. Note advice for use and antidotes listed;
   - e. Note whether product is flammable or inflammable.
2. Report the findings of the surveys, and make a display in the room, dividing the products into categories by major use (i.e., pesticides, cleansers, fertilizers).
3. Divide the group into one working group for each category. In groups:
   - a. List the pros and cons for using these products. Include health effects and environmental consequences.

     Example: Pesticides

Pros--	Cons--
-kill disease carriers	-may affect water quality
-make crop yields higher	-may destroy soil
-make the country more attractive	-may eventually harm human health
-kill weeds	

   - b. Discuss the following questions:
     1) Considering pros and cons listed, do you recommend continued or decreased use of these products?

2) Does your family use most of these household chemicals?

3) Are most of these products necessary for living?

4) Do you think your family could cut down on the use of these products? How?

5) How might use of the products in the United States affect people in nearby countries?

6) What effects might restricted use of these chemicals have on the world environment?

VARIATION:

Using the list of chemical ingredients, research some of the effects of individual chemicals prior to listing the pros and cons of product groups.

For example:

Chemicals present and their effects:

Ammonium Compounds
Can be lethal to animals, toxic in high concentrations.

Sodium Silicates and Sodium carbonates
These are highly alkaline and are known to irritate the respiratory tract, eyes, and skin.

Phosphates
Rob water of vital oxygen for organisms because of increased algae growth.

Sodium Hydroxide and other caustics
In sufficient quantities, these chemicals increase the toxicity of the water. When they get into the food chain where they are passed from organism to organism, they are lethal to the animals at the end.

Use this information to prepare debates on the pros and cons of use of the products.

PURPOSE: To describe some of the environmental and economic trade-offs involved in the use of pesticides in the forest.

LEVEL: Junior-Senior high school

SUBJECTS: Social Studies, Science

CONCEPT: The management of natural resources is value-oriented.

REFERENCE: Base on an activity from American Forest Institute, 1977b.

MATERIALS: Handout: A Dialogue on DDT
Handout: Discussion Questions

ACTIVITY:

1. Ask students to read the Dialogue on DDT and respond to the hypothetical situation presented.

2. Allow time to investigate and develop personal answers to the Discussion Questions handout.

3. Together, or in small groups, exchange views on the Discussion Questions.

4. As indicated on the Discussion Question handout, develop a method to resolve the situation.

In their search for alternatives and solid criteria, encourage participants to consult the following references. Because of the considerable quantity of popular literature available on the effects of DDT (most of it less than objective in its presentation), only a highly selected list is given. Further information is extensively referenced in these documents:

Articles

Edwards, J. G., "One Step Beyond: An Inquiry Into Research on DDT." Available from the Terra Society, P.O. Box 110, Mt. Prospect, Illinois 60056.

Hinckley, A. D., "The Gypsy Moth," Environment Vol. 14, No. 2 (March 1972), pp. 41-47.

McCaull, Julian, "Questions for an Old Friend," Environment Vol. 13, No. 6 (July/August 1971), pp. 2-9.

McIntire, Greg, "Spoiled by Success," Environment Vol. 14, No. 6 (July/August 1972), pp. 14-29.

Pamphlets

U.S. Forest Service, "Major Outbreaks of Douglas Fir Tussock Moth in Oregon and California," (Portland, Oregon: Pacific Northwest Forest and Range Experiment Station, 1973) General Technical Report PNW-5.

U.S. Forest Service, "Surveillance Report 1965 Burns Project Douglas Fir Tussock Moth Control," (Washington: G.P.O., 1968) S/N 994-184.

NOTE:

While the dialogue represents a hypothetical situation, the data regarding the effects of DDT on salmon runs reflect the results of actual research. For a review of actual case histories see: Rudd, Robert L., Pesticides and the Living Landscape (Madison, Wisconsin: University of Wisconsin Press, 1966) pp. 106-109. The original research was reported by: Crowter, R. A., and E. H. Vernon, "Effects of Black-headed Budworm Control on Salmon and Trout in British Columbia," Canadian Fish Culture No. 24:23-40 (1959); Keenleyside, M. H. "Effects of Spruce Budworm Control on Salmon and Other Fishes in New Brunswick," Canadian Fish Culture No. 24:17-21 (1959); Kerwill, C. J., "Effects of DDT Spraying in New Brunswick on Future Runs of Adult Salmon," Atlantic Advocate Vol. 48, No. 8, pp. 65-68 (1958).

DISCUSSION QUESTIONS

How well informed do Mr. Wilcox and Mr. Davis appear to be?
What can these people do to solve their problem? What are their choices?
It is possible that Mr. Wilcox does not have the choice to use DDT, given bans on its use in recent years.
What are the reasons for bans on use of DDT and bans and restrictions on use of other pesticides?
What pesticides are currently allowed, for what reasons, and under what conditions?
What possible positive and negative effects might result from use of specific pesticides you research?
What possible positive and negative effects might result from no use, attempting no chemical treatment of the problem?
What environmental effects might use of the chemical in the U.S. have on other countries?
Is DDT available for use in this country? In other countries?
What effects have been documented on DDT use?
How would you resolve the dilemma outlined in this hypothetical situation? What information do you need before making your decision? On what criteria would you base your judgment? What legal constraints must be considered? What alternatives are available which have not been discussed? Which of the alternatives seem most reasonable? Given sufficient information concerning this hypothetical situation, what solution seems most appropriate?

A DIALOGUE ON DDT

"Those insects have to be stopped before they destroy our entire forest," Bob Wilcox, president of the Freight Lumber Co., said. "They are killing nearly all of the trees and if we don't spray them soon with DDT our company will be without a continuing lumber supply--and that means the mill will close."

"I agree you've got a problem," responded Chuck Davis, owner of Oldtown's largest salmon cannery. "But you can't use DDT. A few years back they used it up in New Brunswick on spruce budworm, the same bugs we've got, and it cut their annual salmon run down to about one-sixth of what it had been. If that happens here, my company would be wiped out--and so would all the jobs on the fishing boats."

"But DDT is the only pesticide that will do a quick and thorough job on those budworms," Wilcox argued. "I don't want to destroy your operation and kill all those fish, but I've got my own company, and all those trees to consider. If I don't spray I'll be ruined."

PURPOSE: To investigate the problems associated with pest control.

LEVEL: Junior high-Senior high school

CONCEPT: Use of pesticides had advantages and disadvantages and requires careful consideration.

REFERENCE: Based on Hernbrode, 1978, pp. 57-59.

MATERIALS: Copies of handout (Shall We Spray?)

ACTIVITY:

Distribute copies of the handout and ask students to read and respond to the situation.

After students are familiar with the situation described divide the class into four groups: the first will advocate the use of DDT; the second will oppose its use; the third will represent a hypothetical International Commission for the Protection of the World Environment; and the fourth will represent the United States Environmental Protection Agency.

The first three groups will research and prepare testimony to be heard by the EPA panel. The panel will decide if the situation warrants issuing an emergency permit for the use of DDT, in accordance with the 1972 regulations banning the chemical. A time limit of 10 minutes should be placed on each prepared testimony.

Students preparing for the hearing should consider:

1. The economic implications and long-range environmental impact of granting or not granting the permit.
2. Alternatives or compromise solutions to the problem.
3. The EPA criteria which must be met before the use permit can be approved. (Students role-playing the EPA should research and establish these.)

The students representing the EPA should familiarize themselves with the 1972 EPA regulations on the use of DDT, as well as any additional amending regulations.

In their search for alternatives and solid criteria, students should be encouraged to consult the references cited below.

Because of the considerable quantity of popular literature available on the effects of DDT (most of it less than objective in its presentation), only a highly selected list is given. Further information is extensively referenced in these documents:

Articles -- Edwards, J. G., "One Step Beyond: An Inquiry Into Research on DDT." Available from the Terra Society, P.O. Box 110, Mt. Prospect, Illinois 60056.

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U.S. Forest Service, "Surveillance Report 1965 Burns Project Douglas Fir Tussock Moth Control," (Washington: G.P.O., 1968) S/N 994-184.

Biological Sciences Curriculum Study, Pesticides (Student Resource Book VI in the Investigating Your Environment Program), 1975. Available from Addison-Wesley Publishing Company, South Street, Reading, Massachusetts 01867 (Code No. 0938).

Simulation/Games -- The Tussock Moth Issue--available from Georgia-Pacific Corporation, 900 S.W. Fifth, Prtland, Oregon. Prepared by the Portland Metropolitan Environmental Education Council.

VARIATION:

Hold a class discussion on these questions:

1. What can these people do to solve their problem? What are their choices? Do either have alternatives available they have not expressed? If so, what are they?

2. How would you resolve this dilemma? What information do you need before making your decision? On what criteria would you base your judgment? What legal constraints and procedures must be considered?

3. Is there something about the quality of oranges that we could perhaps deal with? Would this be a help?

4. What world impacts need to be considered in making a decision to solve this problem?

NOTE:

While the dialogue represents a hypothetical situation, the data regarding the effects of DDT on salmon runs reflect the results of actual research. For a review of actual case histories see:

Rudd, Robert L., Pesticides and the Living Landscape (Madison, Wisconsin: University of Wisconsin Press, 1966) pp. 106-109.

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Keenleyside, M. H. "Effects of Spruce Budworm Control on Salmon and Other Fishes in New Brunswick," *Canadian Fish Culture* No. 24:17-21 (1959)

Kerwill, C. J., "Effects of DDT Spraying in New Brunswick on Future Runs of Adult Salmon," *Atlantic Advocate* Vol. 48, No. 8, pp. 65-68 (1958).

SHALL WE SPRAY?

"Those pesky insects have to be stopped before they destroy the whole citrus crop. Whenever one of those bugs bites into an orange, it leaves a spot--doesn't hurt the fruit a bit--but it marks the skin and people just won't buy a spotted orange. If we don't get in there and spray soon we will lose the crop," stormed the farmer.

"I understand your problem," replied Bob Hartley, the local Wildlife Manager. "But you can't use the poisons you have in mind. I know they are very effective in protecting your oranges, but they are persistent and carry throughout the ecosystem. They destroy the predaceous insects, lizards, and amphibians who eat lots of insects, and we have a lot of different kinds of birds nesting and feeding in the citrus groves. When they eat insects that have died from your poison--and one bird may eat hundreds in a single day--the birds get a terribly heavy shot of the same stuff. If it doesn't kill them directly, it sooner or later affects them via the thinning of egg shells, weakening of newly-hatched birds, or malfunctions. And when we lose the birds, the predatory insects, and these other insectivores, we really get an explosion of insect life--not just in the citrus grove--but in the whole neighborhood."

"But this is the only stuff that works fast enough, and hits hard enough, to do the job," the farmer explained. "When those bugs hatch, we are in trouble right away. I sure don't want to bother those birds, or those other critters either--but dang--my livelihood depends on this fruit being top quality. If I don't spray, my kids don't eat."

PURPOSE: To research the impacts of aerosol sprays on the environment

LEVEL: Junior high - High school

SUBJECT: Science, Language Arts

CONCEPT: Aerosol sprays have serious environmental consequences that can be mitigated by personal actions.

MATERIALS: Copies of Report

REFERENCE: Strategic Environmental Planning, 1977, report #59.

ACTIVITY:

1. Distribute copies of the Report ("Canadian Government to Phase Out Use of Fluorocarbons")
2. Ask students to research and write papers in response to the report. Papers should include reactions to the following questions:
    a. What positive impacts might Canada's actions have on the world environment?

    b. Has the United States limited use of fluorocarbons? Have other countries besides Canada? Should other countries?

    c. What are some other natural or human-induced changes in the stratosphere that might affect weather, climate, agriculture and human health?

    d. What percentage of the fluorocarbons emitted to the atmosphere are produced by the United States?

    e. Do you use aerosol products? How many of the products you use could be used without aerosols? What are some of the alternatives facing you? What actions are you willing to take to reduce your use of aerosols? What actions might be taken in your community?

CANADIAN GOVERNMENT TO PHASE OUT FLUOROCARBONS

Fisheries and Environment Minister Romeo LeBlanc announced on 15 December 1976 that the Federal Government will move immediately to phase out the use of fluorocarbons F 11 and F 12 in Canada. Regulations to be developed under the Environmental Contaminants Act would require the elimination of all non-essential use of F 11 and F 12 in aerosol products during 1978.

A report by the AES Advisory Committee on Stratospheric Pollution indicates that there is little question about the fundamental aspects of the problem and that the continued release of fluorocarbons do indeed present a threat to the earth's ozone shield. Among the consequences of continuous release would be:

1. an effect on the climate although the magnitude of the effect is uncertain;
2. an increase in the incidence of skin cancer;
3. an effect on plants and animals which cannot be protected from harmful ultra-violet radiation; and
4. possible changes in ecosystems.

Ozone is found in the stratosphere. The stratosphere begins at the height of about 16km above the surface in the tropics and at about 8 km near the poles. Depletion of ozone will result in alteration of the temperature in the stratosphere with possible effects on surface temperatures. Because of its geographic location Canada is more susceptible to climatic effects and less affected by increases in skin cancer than countries located father south.

The report calls for Canada to take part in international efforts in the field of research, education and preventative regulations related to the protection of the ozone shield and recommends an increase in research and monitoring effort. It further recommends that the government be prepared to re-examine the problem periodically as new information becomes available and to alter any regulations accordingly.

"Action has already been taken," Mr. LeBlanc said. "As a result of discussions with departmental officials, the aerosol industry has agreed to reduce by one-half the use of fluorocarbons by the end of 1977. Industry will be required to submit progress reports quarterly and consideration is also being given to clearly labelling aerosol packages which contain fluorocarbons F 11 and F 12."

The Minister stressed that it should be made clear that not all aerosol sprays on the market will be affected. Only spray products which use F 11 and F 12 as propellants - hair sprays, deodorants and antiperspirants - will be phased out. Other spray products such as shaving creams, whipping creams and most spray paints use other propellants and are not affected.

It should be noted that Canada produces only 2 per cent of the fluorocarbons emitted to the atmosphere. The Minister stressed that Canada will continue to show leadership by taking measures to limit the release of F 11 and F 12 within Canada but emphasized that further steps toward prohibition must coincide with North American and indeed global action.

Source: News Release (15 December 1977)
Dr. Jim Brydon
Environmental Protection Service
Environment Canada
Ottawa, Canada

PURPOSE:	To explore the problems associated with toxic wastes.
LEVEL:	High school - Adult
SUBJECT:	Social Studies, Science, Drama
CONCEPT:	Individuals must take responsibility for the clean-up of toxic wastes.
REFERENCE:	Based on an activity designed by Susan Denzer at the University of Michigan School of Natural Resources.
MATERIALS:	Copies of handout

ACTIVITY:

1. Divide the group into teams of five to six members.
2. Distribute copies of the handout, and allow discussion. Have each group arrive at one plan of action.
3. Bring the teams together and share the results.
4. Debrief.

DISCUSSION:

1. How might the situation presented have been avoided?
2. How do toxic waste disposal problems affect people in other countries, particularly those near to the point of origin?
3. Do residents of the town in the activity have a responsibility to act? Why or why not?
4. Do the residents have a responsibility to people in surrounding counties? Why or why not?

A TOXIC WASTES CASE

You live in a town that is hundreds of miles away from any industrial center (like Detroit or Chicago). The town has a population of 3000. The major income to the town has been tourism due to Blue Lake, a beautiful clear wilderness lake which is nearby.

Thirty years ago, in the early 1950s, your town convinced a chemical company which was looking for a site to build its plant in your town. The new plant would create 125 new jobs and bring in an $11 million tax base. In the early 1950s the resources of the lake seemed endless, while the prospects for economic growth of the town appeared all too limited.

Following is a chronology of events that occurred after the company broke ground:

1952 - Company breaks ground. Water Resources Commission grants waste disposal permit. Department of Natural Resources (DNR) conducts Blue Lake biological survey, finds healthy aquatic environment.

1955 - Chemical company calls waste disposal "major problem, due to local and state ordinances."

1956 - Company finds that soluble contaminants on the surface will quickly run into groundwater. Company prepares to manufacture C56, basis for pesticides Kepone and Mirex. State requests data on five chemicals discharged in C56 process. Company says it sent toxicity data; state says it never arrived.

1956 - 79 - Company produces 25,000 tons of C56 per year. No state regulator asks about residues. Meanwhile, company stacks 20,000 55-gallon residue drums in woods north of plant.

1973 - DNR surveys Blue Lake, finds trouble.

1975 - Company hires outside consultant to study groundwater. Tests show 10 per cent concentration of firm's discharge water kills fish within 15 minutes.

1982 - Members of community that live downwind of plant become more and more concerned about odors wafting from the plant. It smells odd, like laundry bleach and geraniums mixed toether.

What do they - and you, as members of the community - do?

RESOURCE MANAGEMENT

PURPOSE: To show that unless resources are regulated and protected in the common interest, the inevitable outcome will be the mutual ecological ruin that human ecologist Garrett Hardin has called "the tragedy of the commons."

LEVEL: Upper elementary (with variation for Senior high school - Adult)

SUBJECT: Social Studies

CONCEPT: There is a connection between short-term gratification and long-term crises with regard to resource management. What's good for the individual may not benefit the community.

REFERENCE: Developed by Kurt Frischknecht, Ursula Frischknecht and Karen Zimbelman, University of Michigan, School of Natural Resources

MATERIALS: Cardboard chips, about 1½ inches in diameter. About ten chips for each student should be available in total.
Candies (or something the students value highly). This is really up to the individual teacher to decide what his/her students will be motivated to work for.
Piece of chalk.
Stopwatch.
Record player/record or tape recorder/tape -- for playing music.

ACTIVITY:

1. The Game: The students sit in a circle (if there are more than 30, make two circles). Draw a large square on the floor within the circle so that the edges are about three feet away from where the closest student is sitting. Put 1/4 of the chips in the square. Read the following rules very carefully to the students. Allow time for questions and answers of the rules to make sure students understand thoroughly what the game is.

2. Rules:
   a. The chips belong to all of you.
   b. Everybody may take away from the pool (in the center).
   c. You may trade 10 chips in for a piece of candy.
   d. Music will be played, and as soon as it stops, I will double the number of chips in the pool at that time, and then continue the game.
   e. You may not talk to anyone during the game.

3. Notes to the leader:
   -The length of time that spans between doubling the pool can be varied, but should be a fixed time. We suggest you try 1, 1½, or 2 minutes to begin with.
   -The number of chips after doubling should not exceed the initial number.

In all likelihood, the pool will be depleted before the music stops. Repeat the game two times without giving the students time to communicate with one another in between.

After that, collect information (what happened?); have students report on their feelings. Generate, as a group, cooperative strategies that could ensure a better distribution of chips among the students and still leave the pool largely undisturbed. Play again using these strategies developed by the students.

DISCUSSION:

1. How long did it take in every game until the pool was depleted? (Have one student or on-looker take these times down from the stopwatch.)
2. How many chips were taken out of the pool in each of the different game variations? How many candies did this generate?
3. How did talking about the game make you play differently? How did it make you feel about other members of the group?
4. Did you feel like you had different reasons for playing the game after talking about strategies? Did you feel like other participants had different motivations for taking the chips? How did this make you feel?
5. Have you experienced a similar situation at home, with friends, in your community? (The teacher may wish to provide an experience of his/her own to help students see the similarities.)
6. Develop in a guided discussion how, in the long run, more can benefit if the individual restrains from taking too much, and what attitude is needed among the individual members to achieve the goal of the greatest benefit for all.
7. Make a parallel between the chips and candies, and a forest and tree (paper and wood products) usage.
8. How do the concepts discovered here relate to management of world resources?

VARIATION:

LEVEL: Senior high school - Adult

MATERIALS: A shallow, non-breakable, open bowl (best diameter is approximately 12 inches).
Hardwood hexagonal nuts (or some sort of token), at least 50. (Each token represents one point, 10 points are worth an exemption from a test or something else which would be an appropriate incentive in your particular situation.)

ACTIVITY:

1. Divide the class into at least three groups.
2. Each student groups will play the BASIC GAME at least twice, and then one of the variations (Games B, C, or D). Within the class as a whole all of the variations should be played so as to compare the results (i.e., there should be a minimum of three groups).

a. BASIC GAME

1) Four or more students sit around a table with the nuts bowl in the center.
2) Tell them that the object of the game is for each person to obtain "as many nuts as possible" from a regenerating nuts pool, and following the game's completion, these nuts will be converted to points. Ten points will allow them to be exempt from a test (or some appropriate incentive). Furthermore, if any student scores "enough" points, their total from this game will be doubled.
3) To request nuts from the pool each round, students are instructed to individually select either 0, 1, 2, or 3 nuts during their turn. These nuts have to be displayed in front of each player allowing the other players to see individual "stock" totals for each person. Each player should also see the number of the nuts remaining in the pool.
4) There is no communication allowed between players during the game (Exception -- game D version -- see below.)
5) Replenish the nuts pool by doubling the amount of remaining nuts at the end of every second round. The total number of nuts at the start is 15.
6) Play the basic game at least twice.

b. GAME WITH INFORMATION PROVIDED (group 1)

1) Instructions as for BASIC GAME.
2) "Now you know what the game involves. If people take nuts out of the pool in limited quantities, the pool has time to catch up with itself, and in the long run, there will be more nuts available in the pool. On the other hand, if people take nuts out of the pool very rapidly, people get nuts for themselves very quickly, but the pool doesn't have time to catch up with itself, and soon goes to zero."
3) Play the game one or several times. Communication between students is not allowed.

c. GAME WITH STRATEGY PROVIDED (group 2)

1) Instructions as for BASIC GAME.
2) Read aloud the following:
"Now I'll also tell you a good way to play this game. A good thing to do is just to take 1 or 2 nuts most of the time; this will make the pool last longer. But you're free to make your own choice; I'm just telling you one good strategy."
3) Play the game, one or several times. Communication between students is not allowed.

d. GAME WITH COMMUNICATION ALLOWED (group 3)

1) Instructions as for BASIC GAME.
2) Read aloud the following:
"Now before we begin, I want you to take a couple of minutes to talk together about how you're going to play the game. And you can continue talking with each other throughout the game; in other words, you can communicate as you go -- talk to each other, ask each other questions, etc."

DISCUSSION:

1. Evaluation of games:
   a. What percentage of the different games ended in collapses (i.e., the pool was totally emptied)? In how many games was the trap of over-exploitation avoided (for each of the variations)?
   b. What is the total number of points obtained per game-type per person? per group? for all groups combined?
   c. What is the number of points replenished to the pool per game type?
   d. What is the range in personal point totals within groups and the different game types (index of intragroup unity)? (For graphical representations of 1-4, see Reference 4.)

2. Discussion questions:

   a. Discuss the difference in results.
   b. Ask the students for their reactions to the experience.
   c. Do the students have their own experiences in similar commons situations? with similar problems?
   d. Which game type did best in terms of pool maintenance? Why?
   e. In which situation did the individual profit most? In which situation did the community profit the most?
   f. Which strategy is the best for the well-being of the community in the long run?
   g. Discuss how students arrived at their own personal strategies for "harvesting nuts" in each of the game types. Were the decisions they made bad? logical? profitable? If so, for whom? What was bad about the decisions? What was good about the decisions?
   h. What could the nuts represent in real-life situations? (Explain and discuss the differences between non-renewable and renewable resources.)
   i. What types of "commons" exists in a) the family, b) among friends, c) in your own community/city, d) worldwide? Introduce the historical background to the commons problem (e.g., commons as pasture land and overgrazing -- see Reference 1), and recent problems of commons, such as forest harvesting, depletion of clean air and water, over-use of land, worldwide food consumption (renewable) vs. gasoline consumption, mineral and metal depletion (e.g., phsophorus, copper), etc. (non-renewable).
   j. Discuss the problem of the logic of the individual (consumer) vs. the logic of the community.
   k. What could the nuts represent in real-life situation? Explain and discuss the differences between non-renewable and renewable resources.
   l. Are there any solutions apparent (e.g., private share of stock and responsibility for resources, new morality)?
   m. Discuss the problem of worldwide resources distribution and/or the equity issue.

EXTENDING THE ACTIVITY:

1. History of resource depletion in ancient cultures.
2. Curves of production of substantial resources such as oil, copper, iron, etc. in the U.S.
3. In-depth, case study of a particular resource and its management and usage; how the commons dilemma applies to it in particular.
4. Examine the commons problem and its specific ramifications on a current political topic; i.e., nuclear energy, coal usage, etc.
5. Prepare and make a class presentation of a thorough examination of alternatives/solutions to the commons dilemma advocated by interest groups or alternative agencies (historically or currently).

FURTHER REFERENCES:

*1. Hardin, G. The tragedy of the commons. Science. 162: 1243-1248 (1968).
*2. Edney, J. Free riders en route to disaster. Psychology Today 13 (3): 80-87, 102 (1979).
3. Edney, J. The nuts game: a concise commons dilemma analog. Environmental Psychology and Nonverbal Behavior 3:252-254 (1979).
4. Edney, J. and C.S. Harper. The effects of information in a resource management problem: a social trap analog. Human Ecology 6 (4): 387-395 (1978).

*Required reading for teacher/leader before directing the game.

PURPOSE: To help students examine and describe possible long-range effects resulting from an action.

LEVEL: Upper elementary school

SUBJECTS: Science, Social Studies

CONCEPT: The management of natural resources is value-oriented.

REFERENCE: American Forest Institute, 1977a.

ACTIVITY:

Pose the following situation to your students:

> We have six fully grown trees on our land. We have no other trees around our house or anywhere else on our land. We need firewood and are trying to decide whether to cut all the trees down during next winter to use them for firewood.

Given the information, try to decide what seems to be the best action to take.

Consider:

- What will happen next summer when it gets hot? (No shade.)
- What might happen the following winter when more firewood is needed to keep warm? (No fuel for cooking and heating.)
- What problems might there be for animals? (Fewer places for some birds and squirrels to live.)
- What might a person do to be sure that there are trees left for the future? (For example, each time a tree is cut two could be planted.)

DISCUSSION:

1. Through discussion, emphasize to the students the differences between short-term and long-term results of actions they recommend. Ask the students to describe the long-range effects of any action they recommend.

2. What impacts might there be on the world environment if all people in similar situations decided to cut down the trees on their property?

3. How do these ideas relate to major forestry industries? What impact can these industries have on the world environment?

PURPOSE: To illustrate a societal conflict relating to use of the environment.

LEVEL: Upper elementary school

SUBJECT: Social Studies

CONCEPT: The management of natural resources is value-oriented.

REFERENCE: Bowman, 1979b, p. 34.

ACTIVITY:

1. Pose the following stuation to your class and allow each student to decide how they feel about fogging in the case presented.

   Mr. A and Mr. B are neighbors. Mr. A is unemployed due to a physical handicap. He does, however, earn income from keeping several beehives and producing honey. Mr. and Mrs. B and their family are sensitive to mosquito bites. Their city will provide fogging services during the mosquito season for those citizens requesting the service. However, fogging kills Mr. A's bees as well as Mr. B's mosquitos. Thus, if the area is fogged, Mr. A loses his income; if it is not, Mr. B's family may be bitten by mosquitos.

2. Form groups of 4-5 students and share feelings about who has the right to make the fogging decision in this situation, and what that decision ought to be. Try to reach consensus.

3. Bring the class together and exchange results of group discussions.

DISCUSSION:

1. Many decisions regarding the management of natural resources are value-oriented like the one in this case. Discuss similar decisions made on a personal, local and national level and point out the influences on surrounding commmunities and countries that such decisions might have. Who should be responsible for making these decisions?

EXTENDING THE ACTIVITY:

After a class discussion, check with local authorities to determine how this problem would be handled in your community.

PURPOSE: To describe the effects of industry locating in a town.

LEVEL: Upper elementary

SUBJECT: Social Studies

REFERENCE: Bureau of Land Management, 1971.

ACTIVITY:

One of the main reasons for people moving to the cities in this century has been the location of jobs. People in the city depend upon their job for an income which will buy food produced in the rural area as well as other goods and services. Both good and bad effects result from an industry locating in a town. Jobs are created and income flows in the town, but negative effects can also occur.

What is the main industry (or industries) in your town?

About how many people in town depend on this industry for their living?

How might the climate affect the types of industries located in your town and their operations?

Think of the effects (both good and bad) that this industry has on:

land
air
animals
water
the town
people
you

Give some examples:

	Good	Bad
land		
air		
animals		
town		
people		
you		

DISCUSSION:

1. With the impact of this industry on our town now clear, how might the same industry affect surrounding towns? Other states? How is the industry linked with the global environment?

2. A new industry is about to locate in your town. Without stringent safeguards, it could potentially cause damage to the existing environmental quality, such as the factors noted in this activity. What actions can you take?

PURPOSE: To help the students understand the problems involved in making decisions concerning wise use of land.

LEVEL: Junior high school

SUBJECT: Science
Social Studies

CONCEPT: Natural resources are unequally distributed with respect to land areas and political boundaries; thus, conflicts emerge between private land use rights and the maintenance of environmental quality for the general public.

REFERENCE: Bowman and Disinger, 1977, pp. 101-012.

ACTIVITY:

There is little disagreement about the fact that our population is increasing and will continue to do so. Accompanying this increase in population will be the increased need for goods and services. There are times when decisions have to be made concerning how our resources are to be used to provide these goods and services.

The following role-playing situation will help students make decisons as to the wise use of land. Mr. Jones is a farmer who owns a farm of 500 acres at the outskirts of a rapidly expanding city of 100,000 people. Half of his farm is covered with forest, the rest is very productive agriculturally. Mr. Jones enjoys his work as a farmer very much. Recently, Mr. Jones has been receiving much pressure from many sides to sell his farm.

Mr. Allen, a local contractor, would like to buy the property to build a housing development that would provide housing for a rapidly rising population. Ms. Bates, the mayor, feels that site would be perfect for a much-needed sewage treatment plant because of the location next to a river and its proximity to the growing part of the community. A group of business people, headed by Mr. Smith, feel that this area, which is easily accessible to a main highway, would be a perfect place for a shopping center. A civic action group led by Ms. Fields would like to see the county or city buy the farm and utilize the forest and water resources as a camping and recreation area. The president of the state university is very much interested in procuring the site for a branch campus. Ms. Martinez heads the state chapter of an organization that fights world hunger. One of the issues they are concerned with is the rapid conversion of farm lands occurring in this country; her group would like to see the land remain in agricultural production.

Due to the fact that his farm is taxed on the market value, which is very high, and the fact that prices for farm products are so low, Mr. Jones is forced to sell his farm. He has set his price and is aware of all the prospective buyers. Mr. Jones, being civic-minded, wants to make a decision which will most benefit his community now and in the future. He and his lawyer call a meeting of all the groups that are interested in purchasing the farm.

As a class, set up this meeting and act out the various roles. Select a person to represent the mayor, the building contractor, the businessman, Ms. Field, the university president, Ms. Martinez, and Mr. Jones' lawyer. (Note: There may be other roles you would like to include.)

Have the lawyer conduct a meeting with all the above. He or she must allow time for each participant to state his or her case as to why they think the farm should be sold to them. The remainder of the class will represent Mr. Jones. They can be permitted to ask questions after each participant has stated his/her case. When the discussion has ended, have each student decide privately who he or she thinks the land should be sold to.

You may later want to divide the class into groups of 4 or 5 and discuss their decisions. Have them come to a consensus.

NOTE:

This case may be highly simplified and not represent the way these types of decisions are usually made but it does help students understand the difficulties of making decisions about land use.

PURPOSE:	To portray the dilemma of implementing public policy in a society holding diverse values.
LEVEL:	Junior-Senior high school
SUBJECTS:	Social Studies, Science
CONCEPT:	Conflicts emerge between individual values and the maintenance of environmental quality for the general public.
REFERENCE:	Bowman, 1979b, pp. 69-70.
MATERIALS:	Copies of Tellico Dam Information Sheet

ACTIVITY:

1. Divide the class into groups representing the following audiences:
    - a. Tennessee Valley Authority
    - b. trout fishers
    - c. unemployed construction workers
    - d. local environmentalists
    - e. worldwide organization for the Protection of Endangered Species
    - f. financial managers for surrounding towns and cities
    - g. Cherokee Indians
    - h. Congress of the United States

2. Distribute copies of the Tellico Dam Information Sheet to each participant. Allow time (at least 15 minutes) for each group to prepare arguments for its viewpoint regarding the Tellico Dam and its exemption from the Endangered Species Act.

3. Present the arguments to the group representing the Congress of the United States. Each presentation should last no more than 5 minutes.

4. Allow the Congress time to consult the groups regarding any questions they may have.

5. Ask the Congress to move to another area and discuss the situation, arriving at a decision regarding the fate of the Tellico Dam.

   Have one representative of the Congress report its conclusion to the remainder of the group, explaining the general reasons for the decision.

6. While the Congress is conferring, allow class members to exchange questions and open discussion with other group members to gain better perspective on opinions that differ from their own.

DISCUSSION:

1. After a decision has been reached and is understood by the participants, make it known (to those not already familiar with the actual decision) that in October 1979, Congress decided to grant a specific exemption for

the Tellico Dam, ordering it to be completed and closed. What is the class reaction to this decision?

2. Following the activity, discuss what the impacts of the Tellico Dam are on the surrounding communities, the nation, and the world environment. How do these considerations affect the decision made by the class in the initial exercise?

TELLICO DAM INFORMATION SHEET

The Little Tennessee River flows through one of the most scenic mountain and woodland areas of the eastern U.S. The clear, unsilted coldwater stream supported good sport fishing. The Little Tennessee River lies within the Tennessee Valley. When the Tennessee Valley Authority was created in the late 1930s, to control floods which had ravaged the Tennessee Valley and to improve the standard of living in this terribly economically depressed region, it planned to build the Tellico Dam on the Little Tennessee River. Congress appropriated money for Tellico in 1947.

Because of delays, the Tellico Dam construction did not begin until 1967, much to the joy of many people living in the still-depressed vicinity of the dam. Anticipated were such benefits as a proposed planned community to be built with investments from a huge U.S. corporation in the western U.S., influx of industry, enhanced recreation opportunities, and an additional 200 million kilowatt hours of electricity per year of power generation (resulting from water to be diverted from Tellico reservoir to a nearby power-generating dam; Tellico Dam would have no generating capacity of its own). All this promised jobs and prosperity for the area. Others, however, viewed the dam with dread. Farmers were forced to part with land which had been in their families, often for generations. Beautiful forests were cleared from land which would eventually be covered with water. Trout fishers and those who had loved the escape of hiking and backpacking the area abhorred the prospect of the dam. All this took place before the advent of the environmental laws of the later 1960s and early 1970s.

Following passage of the National Environment Policy Act in 1970, an environmental group sued TVA to halt construction of Tellico Dam pending preparation of an environmental impact study. The courts granted this injunction. Further construction was delayed until 1973 while this analysis took place. TVA resumed construction because they believed the impact statement was complete and that the courts were in agreement. In 1974, however, a professor at the University of Tennessee discovered a small minnow called the Snail Darter living in a short stretch of the Little Tennessee River. The Endangered Species Act had become law in 1973. The Little Tennessee River was declared a critical habitat for the Snail Darter. In 1976, TVA was sued to stop construction of Tellico Dam under the Endangered Species Act. The U.S. Supreme Court supported a lower-court order to stop construction. Over $100 million had been spent on the dam. It was now illegal to take the few remaining steps to put it into operation by closing it and forming the reservoir.

Those interested in the economic benefits expected from the dam were outraged that a fish shorter than a person's thumb could wipe out an investment of over $100 million. "Of what value to people is this fish?" they argued. Congress had never intended such a ludicrous outcome, according to those favoring the dam. Environmentalists argued that the law must be scrupulously complied with. Humans dare not continue to obliterate entire species, especially by development projects which also do signifcant harm to the environment in other ways. They pointed out that in the time that the controversy had delayed the dam, other information had become available and the claim that benefits of the dam would outweigh costs was now questionable. Also, the remaining Cherokee

Indians in the U.S. had pointed out that the archaeological site of one of their capital towns, Chota, would be covered by the reservoir.

Pressure built for Congress to consider legislation specifically exempting Tellico Dam from the Endangered Species Act. The facts before Congress in 1979 were: (1) TVA had acted in compliance with its mandate and with the law, but had been reversed by a series of new laws reflecting changing environmental ethics. However, enormous resources had been invested; (2) the people of the region stood to lose much economic benefit; (3) the land had been cleared and much ecological damage done as a price of building the dam; these impacts were already irreversible; (4) some evidence showed that the Snail Darter might be reestablished by biologists in another river. On the other hand: (1) an entire species--unique and irreplaceable--could be destroyed; (2) a beautiful freeflowing river would be dammed; (3) an important archaeological site, a former capital of the Cherokee Indian Nation, would be inundated and lost forever; and (4) specific exemption to Tellico could jeopardize the effectiveness of the Endangered Species Act.

PURPOSE: To investigate local flood plain development and its relation to flooding, based on the experience of residents of Santa Cruz, Bolivia.

LEVEL: Junior high school - Senior high school

SUBJECT: Science, Social Studies

CONCEPT: Flood problems are prevalent in many communities, and this is often due to floodplain development.

REFERENCE: Strategic Environmental Planning, 1977, Report No. 37

MATERIALS: Copies of Information Sheet

ACTIVITY:

1. Distribute Information Sheets to each student and ask them to complete the questions and projects. This may be done in a class discussion following the research period, or given as a written assignment.
2. Following the research, hold a class discussion on flood plain development, making note of activities on the floodplain in your community.

SANTA CRUZ EXPERIENCES FOURTEEN-HOUR DOWNPOUR

Santa Cruz, Bolivia was disrupted by floods on 5 January 1977 following fourteen hours of continuous heavy rainfall. Official reports indicate that at least three people died as floodwaters climbed to nearly five feet in the city. Four river banks in the province were weakened by the storm, and damage from these flooding rivers was serious.

The rising waters caused widespread destruction in areas close to Santa Cruz; extensive damage to crops and housing surrounding the city was reported. Thousands of people were left homeless after the initial danger of the flood had passed. The people of Santa Cruz started to rebuild their city, although floods still posed a threat to many communities.

Questions and Projects:

1. In Assessment of Research on Natural Hazards, (MIT Press, 1975), written by Gilbert White and J. Eugene Haas, the authors state that, "Floods are the most widespread geophysical hazard in the United States." The authors report that almost every community in the United States has some kind of flood problem, often cause by drainage systems unable to control increased runoff water from rain storms. Rutherford H. Platt, author of "The National Flood Insurance Program: Some Midstream Perspectives," (Journal of the American Institute of Planners, July 1976), states that "Seven percent of the land area in the United States is subject to periodoc riverine or coastal flooding." Flooding occurs at different times of the year in different regions.

   Find a local flood-zone or topographic map of your city. Locate areas that are subject to flooding during the course of the year. Examine your own neighborhood carefully. Are you in an area subjected to flooding? How does your community deal with such problems?

2. Platt also reports that a recent study of 26 U.S. cities revealed that, on the average, more than half of their floodplain land is developed. Another study estimates that 6.4 million single-family homes in the U.S. are situated in floodplains. Examine areas along a river or coast near you. How much of the floodplain is developed? How much damage has been caused in the past as a result of flooding in this region? Design a hypothetical floodplain management policy for undeveloped lands surrounding river banks and coastal areas. Local or state land-use planning offices may have some policies and plans which will help you make your study.

3. How might floods in Santa Cruz, Bolivia--or anywhere else in the world--affect you? What are some of the environmental connections that can be made regarding events in other places in the world?

PURPOSE: To examine the issues involved in management of the sea and its resources.

LEVEL: Junior high school - Senior high school

SUBJECT: Social studies

CONCEPT: Management of the ocean's resources is complex, involving many value-laden issues and perspectives of many nations.

REFERENCE: Strategic Environmental Planning, 1977, Report No. 38.

ACTIVITY:

1. The United Nations Conference on the Law of the Sea is attempting to formulate conventions on exploitation of the oceans and their resources. No convention has yet been acceptable to the nations meeting at the conferences. Meanwhile, some countries are unilaterally claiming rights to the sea and seafloor up to 200 miles from the coast of Iceland.

   In class, hold a bargaining session between "countries" having an interest in owning or sharing the sea and its resources. Divide the class into sections representing countries. One country should be inland, with no borders on the ocean, but with a definite interest in mining the seabed for manganese nodules and drilling for oil; another country's coastline should be within 200 miles of yet another country, situated on an island. Try to reach an agreement on ownership or sharing of the sea and its resources. (Don't forget to consider the military interests of the countries.)

2. Japan has been conducting an island watch in the western area of the Pacific Ocean in hope of being the first country to spot the birth of an island. If Japan is the first country to spot such an island, the Japanese would claim territorial rights to the island and up to 200 miles of ocean and sea floor off the island's coast.

   Agents from the Maritime Safety Agency (MSA) flying over the Marianas Volcano Belt, noticed ashen brown seawater bubbling at a point 23°29'N, 141°40'E, 1,400 kilometers (900 miles) south of Tokyo. On 10 January 1977, the MSA confirmed the activity as an underwater volcanic eruption. Japanese fishermen consider the area a good fishing ground, with depths as shallow as 150 meters.

   Let's say Japan claims a new island, born by a volcanic eruption. She proceeds to claim the sea's resources for 200 miles around the island. In ten days, the island erodes and disappears. Should Japan continue to lay claim to the area around the former island?

NOTE: For information on the Law of the Sea Conference, write to:

Director
Office of Public Information
United Nations, NY 10017

PURPOSE: To understand the watershed concept of land use management.

LEVEL: Senior high school

SUBJECT: Social Studies, Science

CONCEPT: Land use policy is determined by the interaction of science and technology; social and political factors; and esthetic, ethical, and economic considerations.

REFERENCE: Gail, *et al*., 1974, p. 8.

MATERIALS: Topographic maps of area, including local community.

BACKGROUND:

John Wesley Powell, statesman and explorer, noted in the late 1800's that watersheds are the only logical geographical land use planning units. His wisdom had been overlooked by most planners until recently. Political boundaries cut across watershed boundaries, often dissecting a single watershed into many political units, each autonomous from the others. Counties often use major rivers as boundaries, creating a split down the middle of the watershed, in which those with authority on each side of the river have different ideas about how to use it. Regional planning districts often include parts of many watersheds but seldom the entire watershed of any major stream. Under these conditions, it is obvious that any attempt to clean up water in a town downstream would have, without equal commitment from all towns upstream, little chance to succeed.

Watershed studies are investigations of the use and misuse of the *land* which drains into a stream. Water quality in the stream draining the land is an index of land use quality, and as such is only part of a watershed analysis. It is important that a watershed study begin with a general overview of the entire watershed - its land use, people, potential problems, and stream survey, not just the latter. The watershed is a geographical regional in which you begin. Once the problems are identified and understood, the search for answers may extend well beyond the boundaries of the watersheds, possibly into studies of:

- laws and potential laws that could alleviate the problems at the local, county, state and federal level;

- the processes in society that create the problems and alternatives available to solve them;

- costs and benefits of alternative solutions;

- history of the problems and peoples' attitudes toward them;

- ways of stimulating people to correct the problems;

all of which involve social sciences and none of which are concerned with water pollution *per se*.

ACTIVITY:

1. Using topographic maps, determine the boundaries of the watershed(s) in your community. Locate your home and/or your school within the watershed(s). (NOTE: This is often extremely difficult, perhaps impossible, in urban areas).

2. Make a watershed map of your community and its surroundings. Superimpose on it political subdivisions--county lines, city limits, township boundaries, and the like. Determine why, or speculate as to why, political boundaries were drawn as they were, and how they relate to watershed boundaries.

DISCUSSION:

1. What advantages might there have been, had watershed boundaries been used locally in determining political boundaries?

2. How does land use in an upstream area have implications for those living downstream? Extend this to environmental considerations, such as water pollution.

3. If political boundaries were identical with watershed boundaries, what advantages might exist for community land use management?

4. What special issues are created in management of international watersheds? Are these issues normally considered in resource management? In what areas of our country are these issues significant?

PURPOSE: To describe some of the procedures involved in the preparation of an environmental impact statement for a given site and project.

LEVEL: Senior high school

SUBJECT: Social Studies, Science

CONCEPT: Land use policy is determined by the interaction of science and technology; social and political factors; and esthetic, ethical, and economic considerations.

REFERENCE: American Forest Institute, 1977b.

MATERIALS: Copies of Guidelines for Preparing an Environmental Impact Statement, Copies of Picnic Point Park Data Sheet

BACKGROUND:

On January 1, 1970 the United States National Environmental Policy Act (NEPA) came into being. It created a new preventive mechanism for dealing with environmental problems. The heart of NEPA is found in Section 102. This section requires that all federal agencies prepare a "detailed statement" on "every recommendation or report of proposals or legislation and other federal actions significantly affecting the quality of the human environment." Specifically, these statements, now known as Environmental Impact Statements (EIS), are required for all projects directly undertaken by federal agencies; supported in whole or in part by federal agencies, contracts, grants subsidies, loans, or other forms of assistance; or requiring a federal lease, permit, license, or certificate, which meet the "significance" test.

Since EIS's are intended to assess the impact of a proposed action, a draft statement must be prepared at least 90 days before the proposed action is scheduled to begin, for review by appropriate federal, state, and local agencies as well as the public. Once a statement has been prepared and reviewed, comments received during the review process must be answered. A final statement, incorporating all comments and objections and their resolutions, must then be made public at least 30 days prior to initiation of the proposed action.

If any of the reviewing agencies or members of the general public feel that the prepared statement is inadequate, they may file a court suit to require further research into the project's environmental impact. The adequacy and completeness of the EIS is then determined through traditional judicial procedures. If the EIS is found inadequate, it may be revised and resubmitted. If the statement is deemed adequate, the proposed action may proceed. However, if the predicted consequences are seriously detrimental, further litigation may be brought to prohibit the proposed action.

Environmental Impact Statements are not intended to be justification for proposed funding or action. They are simply detailed presentations of the environmental impacts of and alternatives to the proposed project. The EIS are not intended to screen alternatives solely on the basis of environmental impact. They are prepared to ensure that environmental amenities as well as technical and economic considerations and public desires are equitably considered.

In this activity students are asked to use the following data to prepare Environmental Impact Statements according to guidelines suggested by the Environmental Protection Agency. The competed statements are then reviewed at a simulated public hearing held by the agency that wrote the statement.

ACTIVITY:

Initial Procedure

1. As a class, study the suggested guidelines for preparing an EIS. It would be helpful to obtain several actual EIS reports prepared for projects in or near your community. Students could examine these as they review the guidelines.

2. Divide the class into teams of three to five students each. Then ask each team to prepare an EIS for the Picnic Point Park proposal from the data provided on the Data Sheet.

Concluding Procedure

After the students have competed their EIS reports, the documents should be compared.

Ask the students to discuss:

> How the statements differ in their assessment of the significance of the environmental impact, the alternatives they propose, and the evaluation of the short- and long-term benefits of the proposal.
>
> Whether each group considered the project's impact differently, and if you might have expected all the groups to reach the same conclusion. Why or why not?

Select one member from each of the teams to serve on a simulated Department of Ecology panel which is holding public hearings to receive comments on the EIS prepared. In this hearing, panel members will question the consultants who prepared each EIS to clarify ambiguities or conflicts in conclusions. Students serving on the panel will have had the benefit of participating in the process of writing the EIS. Once on the panel, however, they should not longer speak as if they had prepared the statements. They are now "respected citizens" questioning consultants about the EIS they have prepared. Another group of students might want to assume the role of interested citizens for the purpose of testifying at the hearing.

DISCUSSION:

1. Of what benefit is the EIS process to the local environment? To the world environment?

2. Do other nations require Environmental Impact Statements? Should they?

3. With the knowledge of the EIS procedure gained from this activity, what actions can individuals take in order to maximize the benefits of this process?

VARIATION:

In this activity students will prepare an EIS for a hypothetical or actual study site in your community, using either the federal guidelines or their state's statutes.

Here is the hypothetical situation:

An area in your community has been selected as the site for a 100-unit, two-story condominium housing development.

The site has sewer and water lines within easy access. All existing trees on the land must be removed, but the developers agree to landscape the site when the building is completed. An excavation for the basement also is necessary.

Through class discussion, try to determine:

An appropriate location for the proposed condominium development. (If an actual project which has filed an EIS statement is underway locally, you may prefer to use this for class study.)

Is a site study (EIS) necessary before development may be approved? If so, why?

What are the important environmental factors which should be measured before preparing an EIS? In other words, what data must be collected? How would these factors be measured?

What is meant by "short-term impact" and "long-term impact"?

How long is "long"?

Divide the class into several consultant teams. Each team is to collect part of the necessary data as suggested in the following EIS guidelines and/or according to your state's environmental protection statutes, and write a report.

While doing their research, students could consider:

1. A description of the physical and biological resources of the site.
2. How the existing biotic (life-related) community has adapted to the physical environment.
3. Soil characteristics.
4. Air and water quality.
5. Climatic conditions, including average rainfall, seasonal temperature extremes and averages, number of sunny days.
6. Accessibility of utility lines and transportation links to the site.
7. Unique or unusual characteristics of the site.

After the data have been collected, follow the procedure outlined in the first activity. Teams can prepare EIS reports from the same data and present them at a public hearing.

PICNIC POINT PARK

DATA SHEET

1. The situation: A point of land on nearby Balsam Lake (a federal water impoundment) has been a favorite informal beach for many years. The point is easily accessible although a railroad track on private property must be crossed to get to the beach. It has considerable use because it is one of the few public beach areas left easily reached by residents of the surrounding area. Last year it received 30,000 visitor-days of use.

   After several meetings, the Water and Power Resources Service, which administers the area, has decided that Picnic Point should be proposed as a recreational beach site. An EIS must be submitted because the proposed action will be funded by federal money. Responsibility for preparing the EIS rests with those making the proposal, in this case the Water and Power Resources Service. The EIS which is prepared will be reviewed at a public hearing held by the Service to meet NEPA's requirements.

2. The existing environment: Physical features of Picnic Point include a sandy-gravel beach; a creek running through the park area and emptying into Balsam Lake; and an area graded, but not yet surfaced, for a parking lot.

   Biological characteristics to be considered relate to the lake, the land, and the creek. Balsam Lake is a large, quite deep, human-made lake. It is now relatively unpolluted and contains several kinds of fish with trout the most abundant. However, the water quality is beginning to show some signs of deterioration, possibly because untreated sewage enters the lake from homes and summer cabins on the shore. The lake's edge has algae attached to large pebbles and boulders which attract algae-eating animals and their predators. The shallows serve as a breeding area and habitat for several kinds of animals. Water birds also are lake residents.

   The land was once covered with a forest of western red cedar and hemlock. Since these trees were logged off 50 years ago, bigleaf maple, red alder, a few Douglas firs, and a wide variety of berry and flowering plants have grown up to cover the site.

   Picnic Creek is a fast-flowing stream, not very wide or deep. When it floods, it carries silt from bank cuts, sand, and some larger debris into the lake. The water generally is clear and of high quality except for excess numbers of coliform bacteria; the bacteria count is two to three times the number safe in water for human use.

3. Proposed park development: The development of Picnic Point would include these features:

   Construction and maintenance of an asphalt parking lot for 48 cars, with a bus stop and turn-around; concrete restrooms; a pedestrian railroad underpass 35 feet long, 10 feet wide, 8 feet high and 4 feet below (12 meters long, 3 meters wide, 2.75 meters high, and 1.5 meters below) the tracks; a picnic area on the sandy land between the beach and the railroad track; walkways; landscaping for shade and sand and soil stabilization; and a settling basin for Picnic Creek located just east of the railroad tracks.

Rules prohibiting camping; horseback riding; motor vehicles; log cutting; fires except in designated facilities; unleashed dogs; excessive noise or congregating of groups; pop-open cans; and damage to vegetation, soil, sand, facilities, or native animal life.

4. Design considerations: The development must have plans for sewage disposal from restrooms. Ideally this would be accomplished by building a lift station and force main to transfer sewage to the community's new treatment plant now under construction about 3600 feet (1200 meters) from the restroom location.

   The design also must allow for sealed catch basins in the parking lot to prevent hydrocarbon run-off into Picnic Creek and consider the flow increment added to the creek by water run-off from the new asphalt parking lot. Although a large flow is not expected, actual data are unavailable.

   The development of the beach area is expected to increase its use from about 30,000 visitor-days annually to 47,000. Facilities must be designed to meet the needs of this greater use.

GUIDELINES FOR PREPARING AN ENVIRONMENTAL IMPACT STATEMENT

Environmental Impacts

1. Discuss impacts which may occur to water quality, air quality, noise, solid waste disposal, and pesticide use.

2. Discuss the impacts the project will have on the physical environment such as soils, geologic formations, hydrology, drainage patterns, etc.

3. Discuss methodology to be used to minimize adverse environmental impacts. Where abatement measures can reduce adverse impacts to an acceptable level, the basis for considering these levels acceptable must be outlined.

4. Discuss the economic impacts of the proposed action.

Alternatives

1. Discuss the full range of management alternatives considered in the course of planning the action. The null alternative (the alternative of taking no action) must also be evaluated.

2. Discuss why the proposed alternative was chosen.

3. Discuss alternatives in sufficient detail so others may realize secondary or long-term environment impacts.

Short-Term Use vs. Long-Term Productivity

1. Discuss environmental impact and economic costs and benefits as they relate to short-term uses and long-term productivity.

2. Discuss how actions taken now will (or will not) limit the number of choices left for future generations.

Irreversible and Irretrievable Commitment of Resources

Discuss resources to be utilized and what the replacement potential of these resources is.

PURPOSE: To develop ideas and opinions about planning for wise use of land in a given community.

LEVEL: Senior high school

CONCEPT: Physical characteristics of the natural environment are of major importance in determining land use.

REFERENCE: Jamason, 1977.

MATERIALS: Copies of the four worksheets for each student, map of community.

ACTIVITY:

Provide class members with copies of Worksheet I. This worksheet contains important facts and generalizations concerning land use in the United States. The information will be useful as students develop their own ideas and opinions about planning for wise use of the land.

Obtain a map of the community which illustrates, among other things, remaining vacant land. Duplicate and provide copies to the students. Introduce the planning activity of this seminar by describing the following hypothetical situation:

> Our community, faced with a rapidly increasing rate of growth in the coming years, has decided it must make some decisions about the best use of remaining vacant land. You are part of a committee which is evaluating new zoning laws and planning for local land use regulations. You are particularly interested in considering the best uses for one undeveloped piece of land in your community which has become the center of controversy over future use.

Divide the class into groups, each assigned to pick a different use for the same parcel of land. Assign an adversary role to one or more members of each group. For example, if the group decides to build a park, assign one member of the group to be the "owner" of the land who wants to sell it to a developer so that he or she can retire from his job; or, one member to be an inner city resident who needs public housing that can be built on that spot.

Distribute Worksheet 2 among the small groups in order that each group may develop its findings in an independent yet parallel fashion. The gist and sequence of the questions will give form and substance to each small group's set of conclusions.

As each group reaches its conclusions about wise use of its land parcel, suggest that the members consider what will be the impact of their decision. A brief examination of Worksheet 3 will enable them to anticipate some of the questions that might be asked in an authentic land-use planning situation. In this connection, appoint a review committee, selecting a member from each group, to evaluate each group's decision in the light of the impact of each decision.

> How many of these land use plans would the committee approve, given these impact considerations?

An alternative, more objective means of assessing impact would be to use the chart which is provided as Worksheet 4, using the following instructions:

Use the chart to emphasize the concept of environmental impact.

Substitute project descriptions across the top of the chart as necessary. Areas of impact are listed in the left-hand column. Ask students to fill in the chart using the symbols as in the examples below:

+ = a beneficial effect is anticipated for the environmental characteristic noted; e.g., improved transportation (11) under column (H), airport expansion.

- = an adverse environmental effect is anticipated; e.g., noise levels (3) increase and thus are adversely affected under column (H), airport expansion.

0 = no appreciable change anticipated; e.g., water table (8) under column (H), airport expansion.

Once decisions have been made for every impact feature in a project column, a simple comparison of + and - responses will suggest whether or not the project seems feasible. Many students will wish to qualify some of their decisions, particularly those using the symbol 0. Comments of this nature may be added on another sheet by simple references such as H.11, H.3, H.8.

WORKSHEET 1 - LAND USE DATA

Like all advanced nations, the United States is using land more extensively than ever before. Certain kinds of land resources are becoming scarce--land wihin a reasonable distance of urban centers available for housing, recreation, and waste disposition; land within cities that can be used for transportation, networks, parks and open space; and land to accomodate commercial facilities, housing, and centers of higher education. At the same time, we must conserve valuable farm land in order to provide food, feed, and fiber for our still expanding population and world markets.

Some salient facts:

--4 billion tons of sediment are washed into streams annually as a result of land misuse.
--1,687,288 acres of wildlife habitat have been destroyed by surface mining.
--3,187,825 acres of wetlands have been destroyed in seven states alone. (45.7 percent of the wetland area of Arkansas, California, Florida, Illinois, Indiana, Iowa, and Missouri).
--25 million tons of logging debris are left in forests every year.
--4 million acres of right-of-way are traversed by over 300,000 miles of overhead transmission lines.
--1 million (approximately) acres of forests are clear-cut annually.
--4 billion tons of raw materials are consumed annually in U.S. production, most of which are eventually disposed of as waste on the land.

Our intensive and consumptive use of the land is expected to escalate dramtically in the next 20 years. In fact, all that has been built in the history of this Nation may have to be duplicated. That is, the equivalent of every school, pipeline, power-plant, office building, airport, shopping center, factory, home, and highway that has been built during our first 200 years may have to be matched to accomodate population and market demands projected for the year 2000.

Here are some conservative projections for land use in the U.S. over the next generation.

--19.7 millions acres may be consumed by urban sprawl by 2000--an area equivalent to the states of New Hampshire, Vermont, Massachusetts, and Rhode Island.
--3.5 million acres may be paved over for highways and airports by 2000.
--7 million acres may be taken from agricultural use for recreation and wildlife areas by 2000.
--5 million acres may be lost to agriculture for public facilities, second home development, and waste control projects by 2000.
--492 power stations may be built by 1990, many of them requiring cooling ponds of 2,000 acres or more.
--2 million acres of the right-of-way may be required by 1990 for 200,000 additional miles of power lines.

It will be up to the people and their elected representatives to decide whether the land is to be employed in this way, but presently there is no adequate mechanism to plan or control land use.

WORKSHEET 2 - PLANNING CHECKLIST

What is the projected population growth rate in your community?

What is the anticipated industrial and commercial growth? What planning is being done to provide for this growth?

Has your community inventoried and/or controlled any special areas that would be particularly damaged by high density occupancy? For example, historic sites, cultural assets, unique ecological community, etc.

Is your community benefitting from your state's Agricultural Districting Law, by which a farmer can apply for an agricultural value assessment on his or her land, thus reducing the taxes and relieving the pressure to sell to developers? Does your state have such a law?

Does your community have a comprehensive land use plan? Is this plan adhered to? Whose responsibility is it to implement the plan? What are the qualifications of members of the planning commission?

Is there at least one qualified environmentalist on this board?

What specific laws are in effect to prevent building in flood plains; to control land erosion; to prevent unnecessary clearing of trees and other vegetation; and to control diversion and other tampering with streams?

Does the Zoning Board consult the Watershed Association involved, or the County Planning Board, as to the effect of its decisions on the watershed? If not, why not?

Does the zoning law encourage cluster housing?

What provisions have been made, or are pending, to ensure the continued existence of open land areas in your community?

Does the present tax structure "discriminate" against owners of open land?

- -Has any consideration been given to tax relief for owners of open land, in order to make it easier to retain it as open land?
- -Could such tax relief be considered?
- -When and how could such a proposal be initiated?

Are there laws or regulations controlling the extent to which land may be covered with impermeables? Who is charged with enforcement?

What flood control measures exist? How are these maintained and by whom?

WORKSHEET 3 - LAND USE IMPACT DISCUSSION

Use the following questions as a guide for considering some of the impact your plans will have upon the adjacent land, the community at large, and nearby communities. Consider both short-term and long-term impact. Be as specific as possible. Consider what resources in your community you could use to find the answers to difficult questions.

Air Pollution

Will this use cause additional air pollution in your community? Consider the immediate concentration of the air pollution as well as overall air quality.

Who will be affected by this air pollution?

Is the area in which the land is located already affected by air pollution problems?

Water Quality and Management

Will this use affect the water table and/or long-term water supply needs of the area?

How will this use affect water quality?

Will this use have any effect on flooding?

Is any area going to be paved over, thus causing run-off and flooding, rather than seepage into the water table?

Transportation

Are current transportation facilities sufficient for people to get to the land in question?

Will this cause an increase in traffic congestion?

Can a mass transit mode be used?

Noise

Will this cause increased noise pollution during and after its construction?

Growth

Will this use encourage residential, commercial and/or industrial growth in your community? How?

Global Environment

Will this use have an impact on the world environment? Will it affect surrounding communities, states and nations?

WORKSHEET 4 - PROJECT IMPACT

Project Impact	A. Sewage Treatment Plant	B. Highway Construction	C. Apartment Complex	D. Tract Housing	E. Shopping Center	F. Nuclear Power Plant	G. Zoning Change: Commercial to Agricultural	H. Airport Expansion
1. Air Quality								
2. Water Quality								
3. Noise Levels								
4. Natural Habitats								
5. Mineral Deposits								
6. Solid Waste								
7. Contaminants (radioactive; chemical, etc.)								
8. Water Table								
9. Topography								
10. Aesthetic Quality								
11. Transportation								
12. Scenic Areas								
13. Economic Condition								
14. Population Density								
15. "Quality of Life"								
16. Global Environment								

PURPOSE: To understand the "conservation ethic."

LEVEL: Senior high school

SUBJECT: Social Studies, Language Arts

CONCEPT: We have "legal" ownership of some land resources like real estate and control over others during our lifetime, but ethically we are "stewards" rather than owners of the land.

REFERENCE: New York State Education Department, 1977, pp. 86-87.

ACTIVITY:

A major concern relating to environmental quality in general, and certainly to land use, is the consideration of the "ecological conscience"---that is, over and above requirement and legality, what are the ethical aspects of use and misuse of environment? The question has been explored on many levels, from Congress to classroom to pulpit. One of the problems confronting the educator is, "How might the necessity of an environmental ethic be communicated without preaching or brainwashing?"

A number of writers have developed clear statements of the need for a land use ethic which will be meaningful for the high school student. Among them are:

Garrett Hardin, 1968, "The Tragedy of the Commons," Science 162:1243-1248.

Aldo Leopold, 1949, "A Sand County Almanac, Oxford, New York.

Stewart L. Udall, 1963, The Quiet Crisis, Holt, Rinehart, and Winston, New York.

All three of the above, and a number of other titles discussing "the conservation ethic," are available in reprint and paperback from several sources.

Using readings such as these as background, questions such as the following may be addressed in writing or in class discussion:

1. How did early American Indians demonstrate a lifestyle compatible with the environment?

2. Contrast the uses of land by American Indians before European settlement of the New World with the land use practices of early American settlers. What generalizations might be drawn?

3. How did differences in land use practices and "conservation ethics" contribute to conflict between early American settlers and Native American Indians?

4. Does a conservation ethic currently exist in this country, to the extent that sound land use planning and management will occur? Explain.

5. How can privately owned land be managed in the public interest? Should it be?

6. How does the "conservation ethic" in the United States compare to that of other countries?

7. What is a personal conservation ethic? Do you have a personal conservation ethic? Do you put your beliefs into practice? Could you do more? If so, what? What prevents you from living out your conservation ethic?

POLLUTION

PURPOSE: To collect and examine airborne particles in several neighborhood sites.

LEVEL: Upper elementary

SUBJECT: Science

CONCEPT: The management of natural resources to meet the needs of successive generations demands long-range planning.

REFERENCE: Roller, 1972.

MATERIALS: A piece of cardboard approximately 12" square covered on one side with masking tape -- sticky side up. A clear plastic film can be used to protect the sticky tape until you are ready to collect particles.

ACTIVITY:

Place a tapeboard on an outside school window sill, facing the general direction of the wind and airborne particles.

Place a tapeboard on an inside school window sill.

Make tapeboards for the students to put inside their homes and bring back to school in a week.

Burn a newspaper or cardboard box outdoors when there is a slight breeze blowing. Place tapeboards about 4 to 6 feet upwind and downwind of the fire. Determine the difference in the amount of particulate matter collected on each. Observe smoke or its absence.

In each case, ask students what they think will happen. Watch tapeboard each day for results. Where do the particles come from? What can be done to eliminate these particles? Why is there a difference by location?

After this is completed, extend the activity by selecting several local businesses such as a bakery, a gas station, a food store, and a machine shop. Prepare a letter of introduction to the proprietor asking permission to carry out this activity and explaining what it is that you are going to do.

In each business you have chosen to investigate, tape a collector paper onto a carefully selected wall. One paper should be placed at the floor level and the others should be placed at 2 or 3 foot intervals above each other to as high as you can safely reach. After one week, retrieve the collector papers and label them carefully as to their location and height. Examine each one with a hand lens or microscope. Determine the number and types of particles in one square of each collector paper. Put this information in a chart similar to the one shown

In which business did you find the largest variety of materials stuck to the collector paper? Which business had the greatest amount of particles on the collector papers? Which business had the greatest amount of air pollution?

Were more solid particles collected on the highest placed paper than on the lowest? At which height did air pollution seem to be the worst?

Height Above Floor	Bakery		Food Store		Machine Shop		Gas Station	
	No.	Type	No.	Type	No.	Type	No.	Type
8'								
6'								
4'								
2'								
Floor Level								
TOTALS								

DISCUSSION:

1. In each case, where do the pollutants come from?
2. What are some of the problems associated with air pollution?
3. How are pollutants in your own community related to the rest of the world?
4. Why is air pollution an international problem?
5. What can each student do to help reduce air pollutants in your community, and thus in the world environment?

PURPOSE: To inventory pollution in the local community.

LEVEL: Elementary school - Junior high school

SUBJECT: Social Studies, Science

CONCEPT: Pollution occurs in many forms, and can be easily found in the local community.

REFERENCE: Based on a Pollution Inventory developed by Daniel F. Kesselring and Janice Moore.

MATERIALS: Copies of the Pollution Inventory for each participant or team of participants.

ACTIVITY:

1. Divide the group into teams of about 5 people each.
2. Using the Pollution Inventory as a guide, ask each team to survey a specific area around the school (elementary) or the surrounding community (junior high) for examples of various forms of pollution.
3. Record results on a master chart (a matrix indicating types of pollution on the vertical axis and locations on the horizontal axis can be used).
4. Evaluate the results.

DISCUSSION:

1. What types of pollution are most prevalent in the area examined?
2. Which of the examples of pollution could be changed by individual actions? What can each participant do to decrease at least one kind of pollution?
3. How do the problems in this area studied relate to the pollution problems facing the world environment?

EXTENDING THE ACTIVITY:

Following the discussion, have each participant write and sign a contract agreeing to take at least one additional action that will help to decrease local pollution. In one month, evaluate the performance on the contracts, and decide whether to continue the actions. Discuss the feelings involved in actively contributing to the betterment, however small, of the world environment.

POLLUTION INVENTORY - THINGS TO LOOK FOR

LANDSCAPE POLLUTION

1. Litter (paper, bottles, cans, construction debris, etc.) lying around school yards, parks, parking lots, vacant lots, roadsides, streams, adjacent to construction sites, etc.
2. Junkyards and uncontrolled dumping.
3. Abandoned automobiles.
4. Undesirable views from residential areas, parks, etc., caused by poor land use planning. For example, industry next to residential and park areas, residences next to heavily travelled highways, etc.

NOISE POLLUTION

1. Excessive highway noise.
2. Excessive noise from loud automobiles, machinery.
3. Low flying aircraft.
4. Household appliances.
5. Television, radio, stereo playing too loud.

AIR POLLUTION

1. Open burning.
2. Automobile exhaust.
3. Excessive smoke from buildings.
4. Gasoline-powered lawn mowers, edgers, scooters, incinerators, etc.
5. Cigarette, cigar and pipe smoking.
6. Aircraft exhaust smoke.
7. Dust and blowing soil on playgrounds, construction sites, farms, etc.

WATER POLLUTION

1. Soil erosion from bare soil on construction sites, developing areas, farms, etc. Eroding soil washing into streams and lakes, and causing sediment pollution of water.
2. Lakes choking with algae, weeds and sediment.

3. Discolored murky water in lakes and streams.

4. Dead fish in lakes and streams.

5. Excessive use of lawn and garden fertilizers and sprays.

6. Dumping of untreated or inadequately treated sewage or industrial wastes into rivers.

7. Oil leaks from automobiles, machinery, factories, boats, etc.

8. Dumping of any foreign organic material into lakes and streams, including leaves, litter, garbage, soil, etc.

PURPOSE: To simulate the problems involved in group decision-making as related to the urban environment.

LEVEL: Junior high school

CONCEPT: Environmental management involves the application of knowledge from many different disciplines.

REFERENCE: Bureau of Land Management, 1971.

ACTIVITY:

Present the following problem to your class:

An industry in town is putting out great quantities of black smoke as a result of the burning of its waste products. The town is located in a valley, which means the smoke is not blown away easily. A group in town has formed to stop pollution of the air. This group is complaining to the town council about the smoke problem.

The industry says it cannot afford to change its method of waste disposal. Other people in town oppose the control of the smoke because they feel it will discourage new industry from moving to their town. They say it would prevent economic development.

Divide the class into the following groups: Town Council, industry representatives, Citizens for Clean Air, Citizens for Economic Development (see descriptions in following paragraphs).

Each group should meet and discuss what it wants the town council to do about the problem, and what the group thinks is needed to make the town a better place to live. The ideas should be based upon some research into the problem, not just personal opinion. In the preparation of their position statements, each group should consider economic and environmental impacts on the local, state, national and international levels. Elect a spokesman for each group to present its "case" to the town council when the class meets as a whole again.

The town council should elect one of its members to be in charge of the meeting. After listening to the representatives from the different organizations the town council should come up with a list of priorities, a list of what it is going to act upon first, second, etc. Your class may wish to invite a member of the real town council to meet with you and discuss your ideas.

Each group should be presented with the following descriptions:

1. Town Council.--This is the town's governing body which will decide whether the smoke pollution will be stopped. The purpose of the other groups is to persuade this council through their representatives that their position is correct.

2. Industry Representatives.--This group represents the industry which is causing the smoke pollution. They are naturally concerned with their interests and want to keep their profits at a maximim. However, they are interested in public opinion and may respond to public pressure. The group claims that their economic development will be harmed if strong controls on smoke emissions become law.

3. Citizens for Clean Air.--This group is determined to solve the smoke pollution problem as soon as possible. Its members believe that a clean environment is more important than a profitable industry in town. The group also believes that the waste product being burned could be put to valuable use. Most people in this group do not depend on the industry for their jobs.

4. Citizens for Economic Development.--This group is composed of businesspeople and also individuals who work for the industry causing the smoke pollution. They are siding with the town's economy. However, this group realizes that environmental quality is important and might seek a slow, gradual solution to the problem so that the industry is not hurt.

DISCUSSION:

Based on the decisions made in the simulation, do you feel that local citizens play an important part in directing the actions of the cities they live in? Do people's actions and opinions make a difference to the world environment?

PURPOSE: To show the effects upon a small amount of water when coal is burned over it.

LEVEL: Junior high school - Senior high school

SUBJECTS: Science, Chemistry

CONCEPT: Coal burning is considered to be a primary contributor to acid rain.

REFERENCE: Acid Precipitation Awareness Program, pp. 4-7.

MATERIALS:
Copies of Student Activity Card
Gas generating bottle
Deflagrating spoon
Flat watch glass
Phenolphthalein
.05N NaOH
Bunsen burner
Soft coal
pH paper
Distilled water
Medicine droppers
Safety goggles
Beakers

ACTIVITY:

1. Assign the Student Activity Card. Review the assignment on the card and remind students of laboratory safety procedures.

2. As you help students interpret and explain their findings you will want to help them think about experiments, experimental design, the nature of evidence, the validity and reliability of evidence, how evidence is related to other pieces of evidence, and the relationship between evidence and hypothesis.

DISCUSSION:

1. Why is acid rain an international problem?

EXTENDING THE ACTIVITY:

1. Repeat the process of burning the coal over the water several times.

2. Control the amount of time the coal is burned.

3. Discuss how these restrictions affect the water quality of the simulated lake and relate the findings to actual situations.

STUDENT ACTIVITY CARD

PROCEDURE

Part A.
1. Add 15 ml distilled water to the gas generating bottle.
2. Determine and record the pH of the solution.
3. Fill the deflagrating spoon with a lump of soft coal.
4. Use the Bunsen burner in the fume hood to set the coal on fire. When the coal is burning lower it into the gas generating bottle and cover the mouth of the bottle with the flat watch glass plate.
5. Hold the spoon above the water and let the coal burn until the flame goes out.
6. Remove the spoon and swirl the water in the bottle.
7. Determine and record the pH of the solution.

Part B.
1. Place 15 ml of distilled water in a beaker.
2. Add one drop of phenolphthalein solution to the distilled water in the beaker and to the solution in the gas generating bottle.
3. Add drops of NaOH solution to the distilled water and to the solution in the gas generating bottle until they turn red. Record the data.

Observation Questions:

1. Based on your understanding of acids, what are two characteristics you observed which demonstrates that an acid was created?

   a. ______________________________

   ____

   b. ______________________________

   ____

2. Did the pH of the distilled water in the beaker and the solution in the gas generating bottle increase, decrease, or stay about the same? What do these findings mean? ______________________________

   ____

3. What facts did your experiment produce?

4. Scientists frequently use laboratory experiments as models of what goes on in nature.

   a. What relationships have you discovered in this experiment that contribute to understanding what is going on in nature?

   b. What are the limitations of your evidence about what is going on in nature? What are you absolutely sure about? Less sure about?

PURPOSE: To provide an opportunity to critically examine evidence about acid rain.

LEVEL: Junior high school - Senior high school

SUBJECT: Science, Chemistry

CONCEPT: The information available on acid raid and its impact can be interpreted in different ways.

REFERENCE: Acid Precipitation Awareness Program, 1980.

MATERIALS: Copies of Student Activity Card

ACTIVITY:

We exist in a veritable sea of data and are surrounded by a mass of isolated bits and pieces of information about acid precipitation. An important question as science and technology grow and change has to do with knowing, or the nature of knowledge. Which "knowers" are we to trust? In what way(s) do "knowers" know, that is, what processes of knowing do they use? In this section, students have a chance to consider two points of view on the acid preparation dilemma.

1. Distribute Student Activity Card to individuals or teams of students.

2. Allow time to complete the activity card and compare findings.

DISCUSSION:

When students are finished with this activity, ask them what they would say in the following situations. Be sure to consider the global impacts of each situation in the ensuing discussions. These situations can be discussed using an "Agree-Disagree" continuum on paper or by standing along a continuum set up from one side of the room to the other.

1. "All this talk about acid rain drives me nuts. We really don't know whether it's a problem."
2. "You tell me that lots of acid rain is caused by coal-fired plants. You know what my answer is? More nukes!"
3. "I think acid rain is one of the biggest arguments for energy conservation."

NOTE:

Reading A is from: Environmental Protection Agency
Research Summary: Acid Rain
October 1979

Reading B is from: Acid Rain
Northern States Power Company

STUDENT ACTIVITY CARD

Read and Respond

A. As a result of the combustion of tremendous quantitities of fossil fuels such as coal and oil, the United States annually discharges approximately 50 million metric tons of sulfur and nitrogen oxides into the atmosphere. Through a series of complex chemical reactions these pollutants can be converted into acids which may return to earth as components of either rain or snow.

B. What do we know about the causes of acid rain? Very little. Research on this phenomenon has begun only recently.

Although specific causes are difficult to pinpoint, such natural occurrences as volcanic eruptions, bacterial action and lightning are thought to affect rain chemistry.

Emissions from human sources, such as automobiles and the electric power industry, are believed by some to form the chemical forerunners, or precursors, of acid rain.

At present, about 30 million tons of sulfur dioxide, a suggested acid rain precursor, are emitted annually in the United States. About 55 percent of those emissions are from the electric industry. Another 23.1 million tons of nitrogen oxide are emitted each year in America. Automobiles are thought to be the largest single source of this pollutant.

1. For each reading what does the evidence say? ______________________________

____

2. What are the similarities and differences between the two pieces of evidence? ____

____

3. How do you account for the similarities and differences? ______________

____

4. What do these two pieces of evidence mean to you about acid precipitation?

5. Circle and label words which connote biases (b), assumptions (a), and intent (i). What is the point-of-view of the author in each piece?

PURPOSE: To increase awareness of some of the implications of events, trends and innovations regarding acid rain.

LEVEL: Junior high school - Senior high school

SUBJECT: Science, Social Studies, Future Studies

CONCEPT: All events, trends and innovations have implications beyond the obvious.

REFERENCE: Acid Precipitation Awareness Program, 1980, pp. 4-6.

ACTIVITY:

The future (or implications) wheel is a tool which is used to explore possibilities. It is not a decision-making tool. It is meant to increase awareness of some of the implications of events, trends and innovations.

As a group, or in teams of 4-6 people, create future wheels on one or more of the following topics surrounding the issue of acid rain.

1. Newspaper articles, television documentaries, and magazine articles about acid rain increase.
2. Increase in heavy metals in fish.
3. Increase cost in generating electricity (due to pollution control costs).
4. Decreasing productivity of land (due to acid rain).
5. Increasing number of lakes incapable of supporting fish (due to acid rain).
6. Increased contamination of drinking water (due to acidic water in lead or copper pipes).
7. Decrease in building of power plants.
8. Treaty which allows U.S. to charge Canada for increases in acid rainfall resulting from their facilities (and vice versa!).

DISCUSSION:

After the wheels are created, decide whether each effect is Good (G) or Bad (B). Assign probabilities to each effect on a scale of 1 to 5, with 1 being almost sure that it will happen and 5 being almost sure that it will not happen. Is the trend, innovation, or event something that you would like to see happen? Why or why not? What can you do about it?

NOTE: A worksheet on construction of futures wheels is included for the information of the group leader. An incomplete sample wheel follows.

CONSTRUCTING A FUTURES WHEEL

LEADER'S WORKSHEET

1. ASK THESE QUESTIONS:

   a. What might occur as soon as (event, trend, or innovation) is introduced to society?

   b. What might occur if (event, trend, or innovation) continues to (increase, decrease, occur) in this fashion?

2. AND MAKE A DIAGRAM
   (an incomplete one is included)

   Place the event/trend/innovation at the center of a sheet of paper, chalkboard or on an overhead transparency.

   Draw a circle around it and ask the appropriate question, for example: "What might happen if acid rain continues to increase in the future?"

   As students respond, place their answers around the central "hub" or node, circle them and connect them with a single line to the central node. These responses are called first order implications. They are indicated by a single line. For each of these nodes or first order implications ask: What kinds of things might happen as soon as this happens? Connect the new implications with two lines.

   Continue this process for about four or five orders of implications. Third order implications are connected by three lines; fourth order implications by four lines and so forth. Futures wheels can get out of control - sixth order implications represent an upper limit.

3. SOME SUGGESTIONS FOR USING THE WHEEL

   a. Stop discussion on a possibility as soon as everyone agrees and move immediately to another possibility.

   b. Be as concrete as possible in describing the possibility.

   c. Work in concentric circles rather than in chains.

   d. Try to make at least one positive and one negative comment at each node.

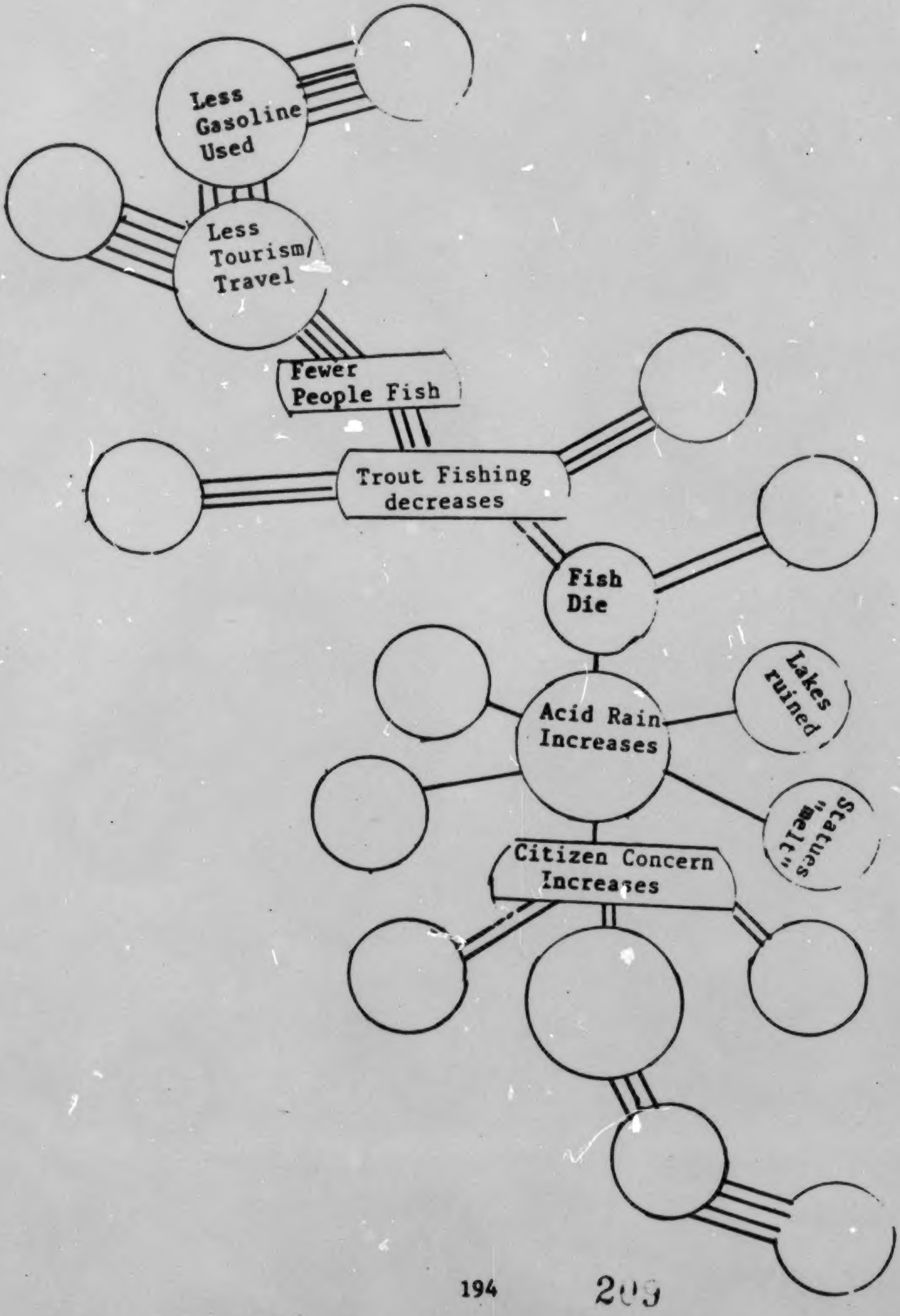
   e. The unusual and the obvious are permitted.

   f. Do not be critical of possibilities. You can ask for an explanation about why the idea is a possibility.

   g. Repetition is permitted.

h. Contradictory responses are permitted. Both alternatives may be possible.

i. The recorder MUST record all possibilities offered. He or she may not be a gatekeeper or filter.


Less Gasoline Used
Less Tourism/ Travel
Fewer People Fish
Trout Fishing decreases
Fish Die
Acid Rain Increases
Lakes ruined
Statues "melt"
Citizen Concern Increases

PURPOSE: To investigate water pollution in a local river.

LEVEL: Junior high school - Senior high school - Adult

SUBJECT: Science, Mathematics, Social Studies

CONCEPT: The human activity taking place in a given area has an impact on local water quality.

REFERENCE: Liston, 1980.

MATERIALS:
Access to a nearby stream or river.
Glass or clear plastic collecting jars.
Masking tape.
Markers.
Secchi disc and cord (see directions).
Dissolved oxygen test kit (optional).
Plankton net (see directions).
Bottom sediment scoop (see directions).

ACTIVITY:

1. Have the students construct materials which are not available (see directions).

2. Choose a stream or river for examination that runs through or past the city.

3. Travel as far upstream as time permits and take samples at intervals of one kilometer for as far downstream as time permits.

   If possible, try to sample water above and below the local waste water treatment plant. If not easily accessible in one trip, a separate study may be done of that area.

4. At each sampling location, have each student keep a record of:

   a. Degree of water turbidity.
   b. Results of dissolved oxygen test (if used).
   c. Odor of water sample.
   d. Amount and kind of predominant shore vegetation.
   e. Kind of human activitty taking place in the area (housing, industrial, farms, woodlot, etc.).
   f. Amount and kind of aquatic vegetation ("water weed", algae, etc.) present.
   g. Observable aquatic animal life present.
   h. Overall aesthetic quality of the water.

5. Obtain a sample of the water and the bottom sediment at each location. Label these carefully according to location with masking tape and a marking pen.

6. Upon returning, make up a large "river quality" table showing results of the tests and observations from site to site going downstream.

7. Arrange the water and sediment samples on a table in the order in which they were taken.

8. Have the students make careful observations about each water and sediment sample on the following inputs:

   a. Order.
   b. Overall clarity of water.
   c. Amount and kind of animal life present in water and sediment sample.

9. Have the students graph dissolved oxygen test results (if used) with dissolved oxygen content at test sites on the vertical axis and distance from the first test site on the horizontal axis.

10. Have them graph Secchi disc results with disc measurement on the vertical axis and distance from first test site on the horizontal axis.

DISCUSSION:

1. How did the Secchi disc and dissolved oxygen test results change as they were taken farther downstream?

2. What makes water turbid?

3. Which of the causes of turbidity can be attributed directly to human activity?

4. What is the relationship between degree of turbidity and aquatic plant growth?

5. If dissolved oxygen test results differed from point to point, how can you account for the differences?

6. What effect would varying degrees of dissolved oxygen have upon aquatic animal life?

7. Did the variety of animal life in the water change as you went downstream? Why or why not?

8. Does the sediment appear to change in some ways as one goes downstream?

9. At any one test site, did the quality of the water appear to change significantly?

10. Identify the points along your tested area of the river where industry or other human activity might alter water quality.

11. Do your tests and observations suggest any relationship between human activity and altered water quality?

12. What businesses or industries along your river can be identified as having a significant impact upon local water quality?

13. In what ways does the recreational value of the river increase or decrease as it flows along?

14. In what ways does your city make use of the river?

15. Are some of those uses in conflict with others? Which use dominates?

16. Does your city have a policy regarding water quality standards?

17. Are those standards enforced? Why or why not?

18. In what ways does local water quality impact on communities downstream? People in other states? People in other nations?

19. Brainstorm as long a list as possible of ways in which individuals in your community contribute to water pollution. Make another list of possible ways in which people can improve or maintain water quality.

Directions for Construction of Testing Equipment:

SECCHI DISK

Materials: metal disc 12-13 cm. in diameter cut from lighweight metal, metal washers, heavy string, black paint, white paint, eyebolt, nuts.

Procedure:

1. Cut disk from lightweight metal.
2. Drill hole in center for the eyebolt.
3. Place a metal washer and nut on the eyebolt, on both sides of the disk. Add more washers if extra weight is needed.
4. Paint disk black and white for contrast.
5. Attach a heavy string to eyebolt and mark it at one foot intervals.
6. Lower the disk into water until it disappears and take a depth reading at this point. Lower it a few feet deeper, then raise it until it becomes visible. Take a depth reading at this point. Average these two readings. This is called the limit of visibility.
7. The Secchi Disk can be lowered into streams from a boat, an overhanging branch, or a bridge.

SEDIMENT SCOOP

Materials: A large can (approximately 20 cm. tall, 10 cm. in diameter), broom handle, nuts and bolts, hammer and nails, drill.

Procedure:

1. Using tin shears, cut the can into a scoop.
2. Punch several small nail holes in bottom of can to allow water to drain.
3. Drill two holes through the broom handle and can.
4. Bolt can securely to the end of the handle.

PURPOSE: To demonstrate the literacy required to understand the complex environmental problems facing today's decision makers.

LEVEL: Senior high school - Adult

SUBJECTS: Social Studies, Communications, Biology

CONCEPT: Material must be analyzed carefully to distinguish fact and fiction. Such action will create increasingly more aware decision makers, and lead to better understanding of the complex environmental problems facing us today.

REFERENCE: Acid Precipitation Awareness Program, 1980, pp. 4-9.

MATERIALS: Copies of Student Reading and Glossary

ACTIVITY:

1. Introduce the activity.

   One of the results of Planet pHison's 0.80, 4-VII Star Search Space Exploration is the arrival of a new shipment of materials to the Environmental Documentation and Analysis Center (EDAC). You work with the Print Materials From Other Space Islands Group. Alystra, the section chief, has asked you for an assessment of environmental conditions with special reference to the atmosphere on planet MW-H-III. She, of course, never says why, just get it done in two days and don't whine to me about lack of funds, time limitations, understaffing and other priorities. In a way, you half hope that you will discover nothing in the materials but the quick-scan computer (SYMSEARCH) spits out these images: atmosphere, pH, pollutants, environmental effects, and the reference: Time, March 17, 1980. Now you have to do it. You feed the reference into the Decode-Recode computer system and push the print option button.

2. Distribute the student reading. A list of definitions is included at the end of the activity.

   a. Ask students either individually or in small groups (3-5) to read it and to evaluate the evidence. Ask the students: "What does the evidence say?" or "What is going on on planet MW-H-III?" These are some things you can ask them to deal with:

      *What appear to be the main sources of the data?
      *What are the main ideas?
      *What examples of the ideas are given?
      *What are the main conclusions?
      *Are these conclusions substantiated by evidence?
      *Where did the evidence come from? How good is it?
      *What is the purpose of the article?
      *Does the article represent one or more points-of-view? If so, what is it? What are they?
      *What are the immediate effects, if any?
      *What are the long-range effects, if any?

*Circle emotionally charged words or words which connote value judgments.
*Is the article a primary account or a secondary account, and, if the latter, on what is it based?
*What does the article say about the ways residents of MH-W-III treat/have treated the environment? The air of MW-H-III? The water of MW-H-III?
*Who appears to make decisions on MW-H-III about environmental treatment?
*What is/are the major concern(s) about the treatment of the environment?
*What are some of the influences on human life (Ask students to place items of data in prescribed categories), e.g.,
- economic
- political
- social
- geographical
- legal

*Are any personal opinions expressed?
*What are the causes of the problem?
*What solutions are proposed? (Ask students to place items of data in prescribed categories)
- economic
- political
- legal
- scientific or technological

*What does Reynolds mean by such expressions as "What have they done..." or "...some smoke in..."
*How does this problem seem to have occurred?
*What problems of regulation does the article suggest?
*Is there any evidence that in trying solve the problem, residents of MW-H-III have made this situation better? Worse?

b. After students have translated the article ask them to write a short report in the form of a report to the Supervisor on the significance of what is going on or on what the data mean to them. The report must include:
(1) What the data mean to them and (2) answers to the following:
-What do you think of MW-H-III as a place to live?
-What predictions would you make for the future of this problem on MW-H-III? in 10 years? in 25 years? in 50 years? in 100 years?
-What effect do you think technology has had on MW-H-III and its people, wildlife and forests?
-Does this appear to be a problem that residents of MW-H-III can deal with? How might it be solved?
-Two possible actions that could be taken and at least one positive and negative effect of each.

DISCUSSION:

1. This may be the first time that your students have heard and/or been asked to read anything carefully about acid rain and the present as well as the future problems associated with it.

a. Does the article convince your students that it is a problem? What kind of a problem? Legal? Economic? Environmental? Political? Technical? (If it is all of these, can they be rank-ordered from most to least important? Which one should be tackled first? Why? Does everyone agree?)

b. How would you go about deciding whether or not acid rain is a problem? Of the topics you read about in the article what is the one that most interests you?

2. Is acid rain one of the worst problems facing the world? Why? Why not? Which one(s) is (are) the worst? Which are not as bad? How do you think these problems have occurred?

3. In the article some solutions to the acid rain problem are discussed. Did they make matters better or worse (or possibly better and worse)?

4. Ms. Reynolds' song is about radioactive fallout. It is possible that the music department may have an album of or lyrics to her music. If you can find either of them, have the class listen to this recording or read the lyrics. Is the "they" the same in both cases? Who are "they"? For acid rain, would you change "they" to "we"? Why or why not? Are "they" (in the lyrics) scientists? Government? Judiciary? Experts? (Who in particular?) Industry? Other? Do we have a deep belief (faith) in the ability of disinterested scientists or technologists or regulations to determine for society what substances pose an unacceptable/acceptable risk? If you regard acid rain as a risk, how would you regulate it?

5. The progress of technology confronts us with choices. Ask students to identify some of the choices in the acid rain article. What value conflicts do some of the choices represent?

EXTENDING THE ACTIVITY:

Individual written exercise:

Who should control actions such as potentially harmful emissions placed in the atmosphere that affect several countries? Who controls such actions now? What can be done about it? (How might it be solved?) What are the advantages of your idea? The disadvantages? Give an example of how it would make the situation better. Worse. If your idea isn't accepted, then what?

STUDENT READING

Acid From the Skies: Corrosive rain has become an insidious menace. (Source: Time Magazine, March 17, 1980).

> Just a litte breeze with some smoke in its eye,
> What have they done to the rain?
> Malvina Reynolds

Already it has killed off the fish in about a hundred lakes in New York's Adirondack wilderness. It has pelted the slopes of the Rockies, and has already affected Scandinavia and much of industrialized Western Europe and Japan. It is a newly recognized and increasingly harmful kind of pollution, invisible and insidious: acid rain, a corrosive precipitation that actually consists of weak solutions of sulfuric and nitric acids.

Last November 35 nations, including the U.S., gathered in Geneva and signed a pact pledging to work together against this skyborne peril. President Carter has authorized a $10 million annual outlay for a ten-year research program on acid rain, which he considers one of the two gravest environmental threats of the decade (the other: increasing levels of carbon dioxide in the atmosphere from the burning of fossil fuels).

Acid precipitation is apparently caused largely by sulfur dioxide emissions from coal-burning power plants, smelters and factories. To a lesser extent, nitrogen oxides from car exhausts and industry contribute to the problem. Rising high into the sky and borne hundreds of miles by winds, these chemicals mix and react with water vapor to form sulfuric and nitric acids. The acids then fall to earth in the form of rain or snow that can damage anything from monuments to living organisms. After a number of such rain showers or highly acidic snow melts, a lake's pH* can plunge low enough to impair the egg-producing ability of fish. Decomposition of organic matter slows, probably because of a loss of scavenging microorganisms. The number of plankton falls off sharply, depleting a vital link in the food chain. Finally, the water appears blue, clear - and virtually lifeless.

The ill effects spread beyond the lakes. In some areas, humans may also be affected. In the Lac la Croix lake system of Ontario, where Ojibway Indians fish for their livelihood, catches are showing high levels of mercury. Reason: the toxic metal, ordinarily concentrated in sediment, changes into an organic form, methyl mercury, in acid water and is then easily absorbed by the fish. While the threat to plants is not as well understood, acid rain can eat away at leaves, leach nutrients from the soil, interfere with photosynthesis, and affect the nitrogen-fixing capabilities of such plants as peas and soybeans. Scandinavian scientists claim the rain has caused a 15% reduction in timber growth. It can also corrode stone statues, limestone buildings and metal rooftops. In the past two decades, Athens' Parthenon and Rome's Colosseum have deteriorated severely; the prime suspect is acid rain. In the U.S. it may cause as much as $2 billion each year in structural damage.

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*pH is a scale, ranging from 0 to 14, for measuring acidity or alkalinity. A chemically neutral solution is denoted by 7, increasing acidity by lower numbers (each one representing a tenfold increase), and rising alkalinity by numbers greater than 7. Rain or snow has a natural pH around 5.6, resulting mainly from atmospheric carbon dioxide, which produces a weak solution of carbonic acid.

Paradoxically, one tactic in the fight against air pollution has contributed to the increase in acid rain. To keep the air clean in the immediate neighborhoods of factories, industry has been building ever taller smokestacks. These belch gases that are out of sight--and out of mind--for local communities, but not for those downwind. The farther the gases go, the more time they have to combine with moisture and form acids. Indeed, scientists have estimated that the world's tallest stack, rising 1,250 ft. above a copper-nickel smelter in Sudbury, Ont., accounts for 1% of all sulfur emissions in the world, including those from volcanoes. All told, Canadian industry and the winds send about half a million tons of these emissions south to the U.S. every year.

But Canada gets more than it gives. Some 2 million tons annually blow north across the border from the U.S., mostly from the industrial Ohio River Valley, which is also thought to be the main source of the Northeast's acid-rain problem. In Europe, says Svante Oden, a Swedish soil scientist, acid rain is equivalent to a "chemical war." Scandinavians claim they are being "bombed" by British and German factories, and similar charges have been exchanged by France and West Germany.

Written before any widespread alarm about acid precipitation, the U.S. Clean Air Act of 1970 gives states a liberal hand in controlling their own emissions to meet federal air quality standards. But it does not assign any responsibility for blights one state may inflict on another. The result has been a see-no-evil attitude that may well require more federal intervention. Also, the 1970 act sets standards only for "ambient," or ground-level quality; acid rain is formed by high-floating emissions.

In some regions, nature itself buffers the effects of damaging rain; alkaline soils and rocks in the vicinity of the lake help neutralize the acidic water. But when man has tried to duplicate the process by spreading lime on and around endangered lakes, the task has proved expensive and only a temporary palliative.

Taking aim at the source of the trouble, the EPA is requiring the installation of scrubbers that remove up to 90% of sulfur emissions at all new coal-fired power plants. But older plants are not covered by the new law, and the problem is likely to worsen as the country turns increasingly to its vaunted ace in the energy hole, coal. "Washing" high-sulfur coal can help. This process involves crushing the coal, then separating out pyrite, an iron-sulfur compound. Because ash, dirt and rock are removed at the same time, washing also makes coal more economical to ship and less damaging to utility boilers. Still, the expense of these measures is staggering. By one estimate, just to cut sulfur dioxide emissions by 50% in the Northeastern U.S. alone would cost up to $7 billion annually.

Yet even at such prices a solution may be a bargain. For as ecologists point out, doing nothing about acid rain now could mean nightmarish environmental costs in the future.

GLOSSARY

ACID RAIN:	A popular term used to describe precipitation which is more acidic than clean rain (which has a pH of less than 5.6 (see also pH)).
AIR QUALITY STANDARDS:	Standards set by federal or provincial governments to control air pollution.
BUFFER:	In soils or lakes, the ability to (partially) neutralize acidic precipitation.
BUFFERING CAPACITY:	In soils or water bodies, the degree to which they can offset acidification.
ECOSYSTEM:	The complex of a plant and animal community and its environment functioning as an ecological unit in nature.
EMISSION:	Refers to substances discharged into the air (usually by human activities) such as through industrial smokestacks and automobile exhausts.
LONG-RANGE TRANSPORT OF AIR POLLUTANTS (LRTAP):	Movement of pollutants through the atmosphere by winds over long distances (hundreds to thousands of kilometers)
pH:	A scale used to measure the concentration of free hydrogen ions in solution, e.g., acidity or alkalinity. pH of less than 7 indicates acids, above 7 alkalines (or bases). A pH of 7 is neutral. The pH of "clean" rain is 5.6. This is due to the normal presence of carbon dioxide in the air which makes rain mildly acidic. Acidic precipitation is defined as precipitation with a pH of less than 5.6. Note that the pH scale is logarithmic, i.e. a pH of 4.6 is ten times as acidic as a pH of 5.6.
PRECIPITATION:	Meteorological term referring to rain, snow, drizzle, hail, and ice pellets.
SENSITIVITY:	With regard to LRTAP, refers to the degree to which ecosystems potentially will be affected by air pollutants or the deposition of air pollutants.

RESOURCES

Acid Rain: Research Summary 1979. (Order from: U.S. Environmental Protection Agency, RD-674, Washington, DC 20460. Free).

Likens, G. E., R. F. Wright, J. N. Galloway and T. J. Butler. Acid Rain. Scientific American, October 1979.

West, Susan. 1980. Acid from Heaven. Science News, February 2:76-78; Acid Solution, Science News, February 16:106-108.

POPULATION

PURPOSE:	To illustrate "limits to growth."
LEVEL:	Elementary school
SUBJECT:	Language Arts, Social Studies, Science
CONCEPT:	The world population is currently increasing at an uprecedented rate and in unprecedented numbers. The earth as a finite system cannot accomodate these increases indefinitely.
REFERENCE:	King and Landahl, 1973, p. 51.

ACTIVITY:

Present the following beginning of a true story:

> Once upon a time there was a space ship with three million people on it. Many of these people were married and wanted children.
>
> It had a limited amount of oxygen, water, fuel, food, etc.
>
> Can you finish the story? Be sure to include consideration of future generations.

DISCUSSION:

After students write their stories, bring the class together to share the varying pictures described. Discuss the relation between this fictional spaceship and the planet Earth.

PURPOSE: To illustrate how populations grow with respect to "carrying capacity".

LEVEL: Elementary-junior-senior high school

SUBJECT: Social Studies, Science, Mathematics, Home Economics

CONCEPT: Carrying capacity caused by the interaction of population growth, resources, and technology is reached and often exceeded whenever pollution is indicated.

REFERENCE: King and Landahl, 1973, p. 49.

MATERIALS: Copies of student handout.

ACTIVITY:

1. Students can work in teams or individually.

2. Present students with the following problem by distributing copies of the student handout.

3. Ask students to read the handout and answer the questions listed. Prepare written lists of suggestions, including as many options as possible.

DISCUSSION:

1. Bring the group together and develop a master list of all the suggestions for regulating human life on the island.

2. Discuss the potential impact of one couple's decision not to have children.

3. Evaluate the master list, and other ideas generated by discussion, in terms of the possibility of these suggestions working for real life on earth, the island in space that's getting crowded.

4. How might one person's actions make a difference?

STUDENT HANDOUT

Sometimes by taking a very small slice of life you can better understand the relationship between people, food and land. See if you can figure out this problem:

> Let's say that four married couples heard about an island that was like a paradise. It had a warm climate, fertile soil, clean air and pure water.
>
> These four couples want to live a simple life. The things they value are to be self-sufficient, to breathe fresh air, live in uncrowded homes, enjoy the natural beauty of their land; to avoid wars and have as many children as they want. So they decide to move to this island and start a new life. They bring along various seeds to get started farming and food enough to last until their crops are ready.
>
> There is enough farm area and living space on this island to support 100 people. This gives the couples plenty of elbow room.
>
> Let's say the couples start having families at age 20 and each couple has four children. An equal number of girls and boys. This would increase the population by 16.
>
> These children marry and start having their own children at age 20 and again each couple has four children. This would increase the population by 32. Their children marry and again each couple has four children.

Can you figure out how long it would take before there were over 100 people on the island and what would happen after there were 100 people? Try and decide how you would regulate human life on the island--or keep it down to the limits the island could support. And finally, if you can, you might see if your ideas would work for real life on earth, the island in space that's getting crowded.

PURPOSE: To develop an understanding of demographic data and implications of these data in a diversity of nations.

LEVEL: Elementary-junior-senior high school

SUBJECT: Social Studies

CONCEPT: Knowledge and skills necessary to evaluate the impact of population changes are necessary for the citizenry, including understanding demographic terms and phenomena.

REFERENCE: King and Landahl, 1973, p. 46.

ACTIVITY:

As a research project, suggest that each student choose an individual country and find out about the population growth rate and the average family size. When the students have completed their research, have the class discuss which countries traditionally have high population growth rates and why. Does it affect their quality of living? Do they have food shortage problems?

DISCUSSION:

1. Which countries have low population growth rates? What are the reasons for this? What quality of living do they have? Do they produce enough food for all their people?

2. What relationships exist between population, quality of living, and availability of food?

3. How do these relationships make you feel about having children of your own?

PURPOSE: To clarify values toward marriage and child-bearing.

LEVEL: Junior-senior high school

SUBJECT: Social Studies, Home Economics

CONCEPT: Personal and collective decisions and actions can change the size and character of populations.

REFERENCE: Schultz and Coon, 1977, pp. 94-96.

Until modern times, high rates of reproduction were necessary to offset high mortality--especially infant mortality. In agricultural societies children were assets in the home- and farm-centered economy. Also, before care of the aged became institutionalized, parents had to rely upon their children for care in their old age. Large numbers of children were advantageous. As a result of these factors and of short life expectancy, American women spent most of their adult lives bearing and rearing four, five, or more children.

Long before the tradition of the large family disappeared, some couples had begun to adopt the small family pattern. As a result of declining mortality rates, a diminishing need for child labor in agriculture, increasing costs of raising a child in an industrialized urban society, and improved methods of fertility control, both the number of children desired and born declined.

Despite this trend, pronatalist pressure (those favoring childbearing) still exists. These include (1) the shaping of the young into sex-typed roles, with the boys pointed toward jobs and the girls toward home and motherhood; (2) discrimination against the working woman and especially against the working mother; (3) restrictions on higher education for women. Such forces are so pervasive that they are typically perceived as natural forces and not simply as cultural prescriptions.

ACTIVITY:

As a way of illustrating these factors, a simple survey activity is suggested for use before classroom discussion. Use the following questionnaire to measure the attitudes of your students.

In tabulating the results, look for the following patterns: Most persons will probably indicate plans for marriage and childbearing that are quite similar--revealing conditioning by cultural and social forces. Note those who do not expect the female to work after marriage: are there differences in male and female responses? Do the answers to the questions on number of children expected and number desired differ? If the same, mention the finding of the Commission on Population Growth and the American Future that 44 percent of all births from 1966 to 1970 were reported as unplanned and 15 percent as unwanted.

DISCUSSION:

In light of the results of the survey and after participants have had a chance to analyze and discuss their own attitudes, offer the following statement from the Commission for further comparison:

> "The objectives for American society should be to make the childbearing decision as free as possible of unintended societal pressures: It should not be to "force" people to become parents in order to seem "normal," but to recognize that some people, and perhaps many, are not really suited to parenthood. We should strive for the ideal of diversity in which it would be equally honorable to marry or not, to be childless or not, to have one child or two or, for that matter, more. Our goal is one of less regimentation, not more."

What impact does decreased population growth in our country have on the rest of the world?

Does decreased population growth in one country have more impact that the same decrease in another country? Why or why not?

What implications does decreased population growth have for the world environment? Does this influence your decision to have children?

SURVEY: MARRIAGE AND CHILDBEARING

1. Female ________ Male _________

2. Do you plan to marry? Yes _____ No _____

3. If yes, at what age do you plan to marry? Age _______________

4. If female and you plan to marry, do you plan to work after marriage? Yes _____ No _____

5. If male and you plan to marry, would you like your wife to work after marriage? Yes _____ No _____

6. If female how long will you work?
   If male how long should your wife work after marriage? Years _____________

7. If you plan to have children, at what age would you expect to have your first child? Age _______________

8. How many children do you want to have? Number ____________

9. How many children do you expect to have? Number ____________

10. At what age would you expect to complete your childbearing? Age _______________

Do you agree or disagree with the following statements?

	Agree	Disagree
11. Part of the fulfillment of everyone's life is in marriage.		
12. Part of the fulfillment of everyone's life is in having children.		
13. A childless or single-child family may have as fulfilling experiences as other families.		
14. If a couple has the number of children they want, but all are of one sex, they should keep trying for a baby of the other sex.		
15. All American couples should have two children in the interests of stopping population growth.		
16. Woman's place is in the home.		
17. After marriage and childrearing, women should continue working.		
18. Because most women marry and leave work when children are born, minor forms of job discrimination and pay discrimination must be expected.		
19. Unmarried women who are in their 40's and 50's are lonelier than unmarried men of the same age.		
20. There is something strange about men or women who do not want to get married and have families.		
21. There is something strange about a married couple who decide not to have children.		
22. A woman should have the right to decide whether she wants to bear a child.		
23. Men and women should share equally in the rearing and caring for children.		
24. Women should stay home and primarily be wives and mothers.		

PURPOSE: To emphasize the world-wide concern for population problems.

LEVEL: Junior-senior high school

SUBJECT: Social Studies

CONCEPT: Political instability seems probable as long as a few nations consume a disproportionate share of the earth's finite supply of resources, including food.

REFERENCE: Schultz and Coon, 1977, p. 76.

ACTIVITY:

1. Review with the class the fact that the United States uses more energy and natural resources per capita than any other country in the world. We own more automobiles, build more highways, produce more chemicals, use more air travel than any other country. We are first or second in producing pollution.

2. Review also the well known fact that millions of persons living in India are malnourished and on the verge of starvation. Indians use, compared to the U.S.A., much less energy and natural resources per capita. Environmentalists report that a child born in the United States will use, during his or her lifetime, at least 30 times as much of the world's resources as will an Indian child.

3. Divide the group in half and assign each half the agree or disagree perspective on the following question: "Resolved that population planning in the United States is just as necessary as it is in India."

4. Allow several days for individuals to prepare arguments according to their assigned perspective.

5. Bring teams of four individuals (two agree, two disagree) together to debate the question.

DISCUSSION:

1. After the debates, bring the entire group together. Hold an open discussion on the issue.

2. Did the debate cause anyone to change their opinions? What was the convincing argument?

3. What is the impact of population growth on the world environment? In light of this, should population be controlled? Does the United States have a responsibility to limit its use of resources? Does India have the same responsibility?

PURPOSE: To clarify values on the question of abortion through the process of role-playing and examination of key differing viewpoints.

LEVEL: Junior-senior high school

SUBJECT: Social Studies, Home Economics

CONCEPT: Personal and collective decisions and actions can change the size and character of populations as related to fertility planning/birth control.

REFERENCE: Schultz and Coon, 1977, pp. 129-132.

One lesson learned by the members of the Commission on Population Growth and the American Future as they studied the matter of abortion was that sensible people could disagree over how to treat the issue. Logical arguments could support several different positions.

The Commissioners themselves disagreed over what laws should exist regarding abortion. Five Commissioners disagreed with the majority's recommendation on abortion and wrote separate statements of their views. Nineteen Commissioners felt that "the matter of abortion should be left to the conscience of the individual concerned, in consultation with her physician, and that states should be encouraged to enact affirmative statutes creating a clear and positive framework for the practice of abortion on request." The Commission admonished that abortion should not be considered a substitute for family planning, but rather as one element in a complete system of health care.

In January, 1973, the U.S. Supreme Court rendered a decision on abortion similar to the Commission majority's recommendation. This ruling specified the following:

For the first three months of pregnancy, the decision to have an abortion "must be left to the medical judgment of the pregnant woman's attending physician." For the next six months of pregnancy, a state may "regulate the abortion procedure in ways that are reasonably related to maternal health" such as licensing and regulating the persons and facilities involved. For the last ten weeks of pregnancy, any state may prohibit abortions, except where they may be necessary to preserve the life or health of the mother.

The Constitutional basis for this decision is described in the following exerpt from the Court's majority opinion:

> "The Constitution does not explicitly mention any right of privacy. In a line of decisions, however,...the Court has recognized that a right of personal privacy, or a guarantee of certain areas or zones of privacy, does exist under the Constitution...
>
> This right of privacy, whether it be founded in the Fourteenth Amendment's concept of personal liberty and restrictions upon state action, as we feel it is, or as the District Court determined, in the Nine Amendment's reservation of rights to the people, is broad enough to encompass a woman's decision whether or not to terminate her pregnancy..."

Despite the Court's ruling, the abortion controversy will continue. The following springboard provides the basis for understanding the complexity of the controversy surrounding the abortion issue. The arguments developed in the following four positions provide an impetus for discussion in which participants examine their own values about abortion.

ACTIVITY:

1. Divide the group into four teams. Assign each small group one of the following four positions on the abortion controversy.
2. Have each of the four groups meet and develop as forceful an argument as possible for the position they have been assigned.
3. Bring the group together again, and ask a representative (or two) from each team to present their argument to the remainder of the group.

DISCUSSION:

1. What are the different human "rights" argued for?
2. Whose rights are involved (mother, father, fetus, society)?
3. What values are the basis for each of the positions?
4. What values seem to be the basis for the Commission's majority recommendation on abortion?
5. Do you agree? Disagree? Why?
6. How do abortion issues relate to world population problems?

NOTE:

Individual students might find it interesting to read and react to the recent rulings on abortion made by the U.S. Supreme Court. SLIP OPINIONS are available from the U.S. Government Printing Office, Washington, D.C. 20402. No. 70-40, Doe, et al., vs. Bolton, Attorney General of Georgia, et al., ($.45) and No. 70-18, Roe, et al., vs. Wade, District Attorney of Dallas County, Texas ($1.00).

FOUR POSITIONS ON ABORTION

1. The first of these positions is total prohibition of abortion except in the case of a direct threat to the life of the mother. It asserts that life begins when the sperm and ovum unite and the genetic basis for a human individual comes into being. Attempts to set the beginning point of life later than formation of a one-celled zygote are arbitrary and dangerous; if there is any doubt, the benefit of the doubt should be given to the fetus. Admittedly, there are many children that are unwanted. But life cannot be made dependent upon whether or not someone, even the mother, wants the child. The child, like all individuals, has a claim to life that is all its own. To liberalize laws to permit abortion is to open the legal door for other socially unwanteds to be eliminated. A society that finds it necessary to solve the social problem of the unwanted child by sanctioning abortion is a society that threatens the very foundations of human dignity.

2. A second position is that abortions should be prohibited except where (1) the mental and physical health of the mother are endangered, (2) there is a substantial threat of a defective child being born, or (3) the pregnancy results from rape or incest. Those holding this position generally assert their concern for the dignity of human life, but contend that a total prohibition of abortion does not serve that goal. Rather, they maintain that the degredation women undergo in seeking illegal abortions, the suffering of defective children, the agony of women pregnant because of rape or incest, the unsupportable burden which many pregnancies impose upon women already in poor physical or mental health, are themselves a basic threat to the dignity of life. Those holding this view believe the law should make provision for abortion in cases of serious stress and that these cases can be spelled out in law. In states where such statutes have been in force, a review board has usually considered whether applications for abortion fall under any of the established categories.

3. A third position is that abortion should be a matter decided by a woman and her physician up to a specified point in pregnancy--usually six months. Those holding this view believe the existence of an abortion law is important to discourage late term abortions as well as to protect the health of the woman involved. The law should allow women, their physicians and other counselors to reach the best possible judgement; a law that is too precise or tries to lay down too many conditions would be a hindrance.

4. A fourth position holds that all laws restricting access to abortion should be repealed. This position holds that repeal of abortion laws would not impose abortion on anyone; it simply recognizes the right of women to come to their own decisions in the matter. Laws that permit abortion for some reasons but not for others are as bad as total prohibition of abortion. They force women into the humiliating and degrading position of having their fate decided by others. Those supporting this position ask why the state, through its laws, should take any position on a decision so fundamentally personal as this.

These positions represent, in oversimplified form, some of the leading arguments for and against the legalization of abortion. Not every person feels comfortable with any one of these stated positions, but in a role-playing situation these perspectives can encourage examination of key differences between pro- and anti-abortion arguments.

PURPOSE: To hypothesize and examine reasons for childbearing through the eyes of three different women immersed in three different cultures.

LEVEL: Junior high school - Senior high school - Adult

SUBJECT: Social Studies, Population Studies

CONCEPTS: The reasons for having children vary in different countries. The opportunities available to women vary in different countries.

REFERENCE: Johnson and Benegar, 1981; Miller, 1979.

MATERIALS: Copies of profiles for each participant.

ACTIVITY:

1. Begin by introducing the subject of childbearing. Why do people choose to have children? Poll some student responses.

2. Pass out "Raksha." Have participants answer questions at the end. Discuss.

3. The accompanying leader handouts can be made into overheads and shared with the participants after they have made their own lists.

4. Repeat this process with Kawe and Mie-Ling.

RAKSHA

Raksha is a real woman who lives near Bombay, India.

My name is Raksha and I live in a small village not far from Bombay. I think I am about 25 years old, but I am not sure. I have five children and expect my sixth soon. I have actually given birth to eight children. I hope this one lives past the difficult first month. I will be glad when my pregnancy ends, since I have been weak and ill. The doctor feels that I should not have more children since I am not well, but in our country it is important to have a male child since that is the only way the man's family continues. My mother-in-law lives with me, and she feels that I should have as many children as God gives me. I will do as she says. After all, it is she who has power. My parents paid a dowry for me and arranged my marriage, too, and I must not disappoint them.

Some women in my country hold jobs, and a few go to school. Women work in factories, hospitals, and offices, something they never would have done 20 years ago. The female literacy rate is still only 18.9%, however.

Answer the following:

1. Explain the term literacy rate.
2. Give some reasons to explain why Raksha does not know her age.
3. What is an arranged marriage?
4. Explain what a dowry is.
5. Give some reasons why the female literacy rate is so low.
6. Why does Raksha's mother-in-law have power?
7. Make a list of reasons why it is necessary for Raksha to have several children.
8. What other jobs could Raksha do besides being a mother and wife?
9. Why doesn't she do other jobs?
10. Is there a relationship between Raksha's opportunities for jobs and her desire to have children?

KAWE

I am Kawe, and I live in a northern farming village of my modernising country. We grow oil palms and farm for a living.

I am now thirty-five years old. I have been married to my husband for 20 years. I am not the only wife of my husband. Even before he married me he already had two wives. I would have been the third except that he divorced the second wife for not bearing a child during the first two years of their marriage. In our society a childless woman is a person to be despised because the spirits did not find her a fitting person and did not wish to be incarnated in her. Both my husband's first wife and I are successful wives, for we have borne children, including sons. Our children can help us farm, can support us in our old age, and can bury us when we die.

My son is going to school to learn to read and write. He needs these skills to become an important person in our village. None of my girls go to school, nor, I think, have any girls from our village. They need to learn skills to help their husbands-to-be on their farms. Some people say that if the girls get educated they might get bad ideas and elope.

Overall, I try to keep my husband happy, provide him with children, who are more precious than wealth to our people, and make him satisfied with the "bride price" he paid for me.

1. How old was Kawe when she was married?

2. What is a "Bride Price"?

3. Think of reasons why girls are not educated in Kawe's Nigerian village.

4. What happened to Kawe's husband's second wife?

5. List reasons why Kawe wants to have children.

6. Does Kawe have an education?

7. What else could Kawe be, other than a wife and mother?

8. What relationship is there between Kawe's choices and her attitudes toward childbearing?

9. Who has more choices, Kawe or Raksha?

10. Who is more likely to have children? Explain.

MEI-LING

Mei-Ling is also a real woman. Her home is the People's Republic of China.

My name is Mei-Ling. Before the revolution of 1949, in my country women were treated poorly. Husbands beat wives, peasants beat children, and mothers-in-law beat their sons' wives. Peasant women worked hard in the field, or as servants to the wealthy; upper class women did no manual work, but concentrated instead on their families and the raising of children. Some upper class women went to universities, but the main purpose of all women was to produce male heirs to continue the husband's name and control his property. Women were denied education and were supposed to stay at home and be subordinate, one reason for the painful practice of binding the feet of girls.

With the revolution of 1949 came many changes in the status and roles of women. In 1950, the first Marriage Law was passed in my country, by which arranged marriages were abolished and widows were given the right to remarry. Women are no longer "commodities" of sorts, but have attained full economic and legal equality. Women have taken the lead in family planning programs, and have full rights in determining the size of their families in accord with state policy. Women work together in family planning at the village and neighborhood levels. As an example, women on a particular street in a village or rural area decide together the number of children which can be reasonably added to the population for that year. They then determine from this how many will be able to have a child. Many women volunteer to wait a year before having a child.

This method has been successful. This can be proved by the fact that the annual population growth rate has remained stable in the period 1973-75, at 1.7 rate of growth. The key to family planning in my country is persuasion rather than coercion. Through education, women can see the positive advantages in practicing family planning. It is more advantageous, for example, to have fewer and healthier children, and thus be free to contribute to the building of the nation, than to have a very large family.

I myself am a full-time worker. I was a medical student before marriage, and worked as a nurse before entering medical school. I did not marry until the age of 25, feeling it important to complete schooling and begin my profession. The state favors late marriage, as it has aided in reducing the population and encouraging young people to work and serve their country. I have 3 children, who attend school six days a week, and eat their meals in state dining halls. Children are often separated from their families for periods of time, and learn early to interact with other people. Yet family ties remain close despite separations. My three-year old girl lives in a full-time kindergarten, but I see her on Sundays. It is good that the state cares for her, since we women need to be free to work for the revolution. I spent a year in the countryside two years ago giving medical care to the peasants. I did not see my family during this year; my children were proud of my services to the peasants. Since 1949, the state has greatly encouraged me in my profession, as it has encouraged women in general to contribute to the welfare of the nation.

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Answer the following:

1. What was life like in China before the 1949 revolution?
2. How has life changed?
3. How is family planning practiced in China?
4. Why did Mei-Ling marry so late?
5. What is her children's life like?
6. What benefits and disadvantages are their to full-time schools for children?
7. Compare Mei-Ling to Kawe and Raksha. What are the similarities and differences?
8. What opportunities are open to Mei-Ling and other Chinese women?
9. How do their opportunities relate to their decisions about childbearing?

ATTITUDES TOWARD CHILDBEARING IN INDIA

LEADER RESOURCE

1. More children can earn for the family. The father can also rest if there are more children to earn for him.

2. A son is important for the family's name. He keeps the "door" open. Many people do not stop having children until a boy comes. At least one son is necessary to keep the family name going.

3. If there is only one son, then he has the whole economic burden--supporting the family and paying for all the ceremonies such as his sisters' weddings.

4. If there are only two children, a boy and a girl, and the boy dies, the mother is considered barren.

5. The advantage of having many sons is that they will have different occupations and earn more.

6. Having many sons means more fame for the family. This way one's own name remains at the top.

7. When there are five or six children, a parent can have a peaceful life in old age. Mothers can depend on their sons because they can rightfully claim anything from them.

8. The biggest advantage of a large family is that when all the brothers unite nobody dares bother them. They can live with power in their hands.

9. If a woman has many children, others will look up to her. When someone asks a woman if she has children, she can say proudly: "I have many children!"

10. Suppose a woman has a daughter and a son. What happens if God takes away one child? If her son dies, then she has only one child to look after her. If a mother has five children, then at least two or three of the children may live.

NOTE: Compiled by Indiana University, Population Education Project, 1973.

ATTITUDES TOWARD CHILDBEARING IN NIGERIA

LEADER RESOURCE

The first and foremost desire of a married couple is for children; having children is regarded as the chief aim of all marriages. Childlessness therefore is regarded as a disease. A woman who can't have children is treated almost as an outcast and has little influence among her people. She is everywhere despised and distrusted. If she cannot have children, everyone is certain it is her fault. The ancestral spirits will not insert a soul in her womb or do not want to be reincarnated in her. Childlessness often leads to divorce or polygamy. Only in the large cities in Nigeria do some people among high income groups believe there is a need to limit family size. Parents want children for many reasons and mothers in particular cherish the idea in spite of the ordeal of childbearing.

Reasons for having Children in Nigeria

1. Children are the yardstick for measuring the success of marriage.
2. Children are a source of social prestige. Parents who have many children are greatly respected, and are addressed by special titles.
3. Children prove their father's manhood and mother's womanhood and remove the stigma of barrenness. Children prevent accusations of impotence and witchcraft.
4. Children are of economic value. They are valued for their help on the farm and in the home. In the olden days they could be pawned to pay off a debt.
5. Children are a great investment. They support the parents in old age and are their heirs forever. Children perpetuate the family and the family name, and ensure decent burial and fame for their parents.
6. Since one is sent into the world to be fruitful and multiply, a large family is evidence that one is loved by the gods.
7. Without children, marriage would break up and even if it continues, the couple would live unhappily.
8. When parents reach old age, their children are expected to clothe and feed them and to give them comfort. In this sense, children are a sure means of social security, pride, and happiness to parents.
9. Most families have their traditional occupations and parents always wish the skills of their trades to be passed on to their children.
10. "It is better to accumulate children than to amass wealth," is a common saying among Nigerian people.

NOTE: Excerpted from Ngwobia Uda, Growing Up in Nigerian Culture, University of Ibadan, Institute of Education, Occasional Publication No. 6, 1966, pg. 35-36.

ATTITUDES TOWARD CHILDBEARING IN CHINA

LEADER RESOURCE

1. Women are encouraged to marry at a later age, to decrease the number of years during which they could potentially have children.

2. In China today, women make the decision as to how many children they will have. Family planning represents the demands of the many women who want to be freed of the burden of many children in order to be able to work for development of the country.

3. The policy of limiting family size is considered an important decision-making area by the government, in order to promote a better life for the Chinese people. Each individual should have as good a life as possible. Quality of life--rather than quantity--is important.

4. Women must be able to see positive advantages in limiting the number of children they have. Education is most important. For example, if women realize that it is better to have fewer and healthier children, and also have more time to study and free themselves, this is a good reason to limit the number of children they have.

5. Women teach one another about family planning, going from village to village. They even decide how many children should be born on a particular street, or in their village, and then determine how many women can have children that year. Many women volunteer to wait a year to have a child.

6. In China, people are much closer than in many other societies. Children do not feel strange when around people other than their parents. Many people feel as though the children of another are their own.

7. In China, children may live apart from their families for short periods of time while attending school. Yet family ties remain closely-knit, and children begin at a very young age to interact with people.

NOTE: Compiled by Anna Chung, Center for Teaching International Relations.

PURPOSE: To clarify values concerning childbearing attitudes.

LEVEL: Senior high school - Adult

SUBJECT: Social Studies

CONCEPT: Personal and collective decisions and actions can change the size and character of populations as related to fertility planning/birth control.

REFERENCE: Schultz and Coon, 1977, pp. 140-141.

ACTIVITY:

1. Indicate to the class that they comprise a group that has been brought together to debate a U.S. Congressional proposal to stabilize the U.S. population. One of the first aspects of implementing the proposal will be to remove tax deductions for children numbering over two per family.

2. Assign students or have them volunteer for one of the roles suggested below. Urge that students try seriously to identify with the role they represent. Allow five to ten minutes for students to prepare a strong justification for their attitude regarding family size. Have spokespersons for each role present their arguments and defend them against arguments from other students who hold other beliefs. In essence students will be challenging the positions and underlying values of others with whom they disagree.

3. If time and interest permit, the activity might be continued with students exchanging roles.

   a. You are a poor ghetto woman. Having babies produces the only thing you have to live for; the only thing you can call your own is your baby (babies, as you have 9 children). Or you are a ghetto male, scarcely ever really staying home to fulfill the role of father to the 9 children you have fathered by your wife. Each time your "wife" becomes pregnant, it is a sign of greater virility for you.

   b. You are a university professor, very concerned about population, and you therefore plan to have one child, but probably none, and contribute to society in other ways. In fact, you believe in negative growth.

   c. You are an average young college student, married or unmarried. You are very concerned about the environmental crisis, and feel every couple should limit their family size to two children to achieve zero population growth.

   d. You are a wealthy developer. You buy up large and cheap parcels of land, particularly when back taxes cannot be paid, and build cheap small houses with small yards on the former agricultural land or woodland. You live in a luxurious home with 15 open, lovely acres surrounding it. You feel that you are serving an important segment of America by building and providing "homes for a growing America."

You very certainly believe in positive population growth and a spiraling Gross National Product. You believe you should have a large family if you can afford it.

e. You are an ultra-conservative Irish Catholic. Your religion as you understand it urges you to consider family size an individual choice. You are, in fact, doing your duty to God by bearing a large family, and you certainly don't believe in birth control unless it is abstinence or rhythm. You have some problems with your sex life, and have also become pregnant nearly every year for the first six years of marriage. Or, you are the husband in such a family, and believe as does your wife. You also belong to the Chamber of Commerce which is encouraging "Growth" for the benefit of the future of your average-sized town. You feel that young "liberal" Catholics are disloyal to your religion.

f. You are a 25-year-old college-educated black woman who wants to continue your successful career. You do not want any children after struggling several years to achieve your present level of success.

g. You are a black militant who feels..."population control is genocide."

DISCUSSION:

1. Discuss the reasons for the development of different attitudes toward childbearing among different populations.

2. In this activity, we have looked at different attitudes among different groups in the United States. How do these attitudes relate to populations of other countries? What correlations can be drawn? How do these attitudes correlate to socio-economic status? What does this say about attitudes toward childbearing in economically advanced countries? In developing countries? In under-developed countries?

3. In what ways do population growth and environmental issues correlate?

4. How do you personally feel about childbearing and population control?

WORLD LINKAGES

PURPOSE: To examine the rights of children, from participants' own perspective and in accordance with the United Nations Declaration on the Rights of the Child.

LEVEL: Upper elementary - Junior high school

SUBJECT: Social Studies

CONCEPT: Children share certain basic rights with people everywhere.

REFERENCE: Johnson and Benegar, 1981, pp. 53-56.

MATERIALS: Copies of Handouts A (What Are the Rights of a Child?) and B (U.S. Declaration on the Rights of the Child), Scratch paper, Overhead projector (optional), display size copy or overhead transparency of the Rules of Brainstorming.

ACTIVITY:

1. Divide the group into pairs or teams of 3 or 4 participants. Give each group a copy of Handout A (What Are the Rights of a Child?) and some scratch paper. Explain that the first part of this activity will involve brainstorming their rights as children. (If the group is not familiar with the brainstorming technique, go over the rules and explain them. If the class has used the technique before, review the rules. Leave them posted where all participants can see them. For your convenience, the rules of brainstorming are listed below.)

   ### RULES OF BRAINSTORMING

   1. Saying anything that comes to mind is okay.
   2. Discussing other people's statements is not okay.
   3. Evaluating or criticizing other people's statements is not okay.
   4. Repeating someone else's idea is okay.
   5. "Piggybacking" on someone else's idea is okay--that is, it is okay to add something to or slightly change someone else's idea.
   6. Silence is okay.
   7. Even if you think you have finished, keep on going for a while.

2. Ask each group to appoint a member to record all the ideas offered. These should be listed on the scratch paper. To get the participants started, you might offer some examples of possible rights: the right to own a ten-speed bicycle, the right to fair treatment under the law, the right to have one's own bedroom, the right to a free education. Allow about ten minutes for the groups to brainstorm lists of possible rights.

3. After the groups have finished brainstorming, ask each group to choose a final list of ten rights that everyone (or almost everyone) agrees that all children in the United States ought to have. These ten rights should be recorded on Handout A. Allow 15-20 minutes for the discussion and selection process.

4. Let the groups take turns reading their lists of rights. Record these on the chalkboard or newsprint sheets and tally any repetitions. Narrow these down to ten or fewer rights on which there seem to be general agreement.

5. Distribute a copy of Handout B to each group (or project the transparency). Explain that this document was developed by the United Nations and that it lists the rights that all children should have, regardless of where they live or in what circumstances. Ask the participants to compare this list of rights with the lists they developed. Did they omit any important rights? Did they list any rights that do not seem so important?

6. Remind the participants that even though children all over the world may be morally entitled to these rights, in fact they do not always enjoy them. For example, children in many countries do not have adequate nutrition and medical care.

DISCUSSION:

1. Which of the rights in the U.N. Declaration do most children in the United States enjoy?

2. How are these rights ensured? What agencies and procedures in the United States are involved with protecting the various rights of children? How do they work?

3. Which of these rights are the easiest to enforce? Which ones are the most difficult to enforce? Why?

4. How are children's rights protected in other parts of the world? If these rights are being violated, what might be done about it by individuals and organizations interested in protecting children's rights?

EXTENDING THE ACTIVITY:

1. Ask the group to search for and collect newspaper or magazine articles that describe how children's rights are being either violated or protected in various parts of the world, including the United States. Make a scrapbook or a bulletin-board display of these articles. If there is a large map of the world in the classroom, you might want to tack or tape the headlines of such articles at corresponding places on the map.

2. Suggest that participants make posters illustrating all or part of the U.N. Declaration on the Rights of the Child. This activity could be expanded to a schoolwide poster contest, with local artists and journalists acting as judges. Try to arrange to display the winning posters at a local library or business.

3. Ask the participant to write papers comparing the Bill of Rights in the U.S. Constitution (the first ten amendments) with the U.N. Declaration on the Rights of the Child.

HANDOUT A

WHAT ARE THE RIGHTS OF A CHILD?

1. ______________________________
____

2. ______________________________
____

3. ______________________________
____

4. ______________________________
____

5. ______________________________
____

6. ______________________________
____

7. ______________________________
____

8. ______________________________
____

9. ______________________________
____

10. ______________________________
____

HANDOUT B

U.N. DECLARATION ON THE RIGHTS OF THE CHILD

The right to affection, love and understanding.

The right to adequate nutrition and medical care.

The right to free education.

The right to full opportunity for play and recreation.

The right to a name and nationality.

The right to special care, if handicapped.

The right to be among the first to receive relief in times of disaster.

The right to be a useful member of society and to develop individual abilities.

The right to be brought up in a spirit of peace and universal brotherhood.

The right to enjoy these rights, regardless of race, color, sex, religion, national or social origin.

PURPOSE: To build awareness that many of our visual images of other places and peoples reflect stereotypical ideas of other regions and cultures.

LEVEL: Upper elementary - Junior high school

SUBJECT: Social Studies

CONCEPT: Many images of other places and peoples which are presented by television and other media are oversimplified, incomplete and/or stereotyped.

REFERENCE: Johnson and Benegar, 1981, pp. 57-59.

MATERIALS: Copies of Handouts A (Where in the World is This?) and B (Where in the World? Worksheet); Large map of the world; Overhead projector (optional). (Handout A can be made into transparencies and projected rather than distributed to each group).

ACTIVITY:

1. Divide the group into teams of three to five participants. Explain that you are going to show them eight drawings, and that they are to work in groups to decide what the pictures show and where in the world each person or thing pictured might be found. Give each group a copy of Handout B and a set of the drawings in Handout A. (If you are using an overhead projector, allow 5-10 minutes for participants to discuss each picture and fill in their worksheets before going on to the next drawing.)

2. Ask the groups to share the guesses they made on their worksheet. On what pictures was there the most agreement? What drawings generated the least agreement? Ask the participants to explain the reasons for their guesses.

3. Announce that all the drawings show places, things, and people that might be found in the Middle East. Ask some students to point out the Middle East on the world map. (Guide them in doing so, if necessary).

4. Ask whether any of the participants were surprised that some of these drawings represent the Middle East. What mental pictures did they have of the Middle East? Where did they get their ideas about what the Middle East is like? (Allow time for students to think about these questions and respond to them.) Were these ideas accurate? Partly correct? Incomplete? Why did they guess that some pictures represented places other than the Middle East? Is the Middle East a simple area to describe? Or is it more complex than they had thought?

5. Ask if anyone can explain or define the word "stereotype." If necessary, help the students to understand that a stereotype is a mental picture of a group of people or things which ignores important differences between members of the group and which is based on incomplete or incorrect information. Point out that a stereotype is usually negative and that it usually does not fit a great many individuals in the group. Write a simplified definition of "stereotype" on the chalkboard.

6. Offer a few examples of common stereotypes. (Texans are rich; kids who wear glasses are smart in school; black people are naturally good at playing basketball.) Ask the students to suggest others. Then ask whether they can think of any stereotypes about people or groups of people in the Middle East--for example, there is so much oil in the Middle East that everyone is rich; all Israelis live on kibbutzes (communal farms); Arabs live in the desert and ride camels. Write some of these on the chalkboard.

7. Ask which of the drawings in Handout A fit or reinforced any of these stereotypical pictures of the Middle East. Which drawings did not fit these images or contradicted them?

8. Encourage the students to speculate about the effects of stereotypes. Do they help people understand one another, or do they create barriers to understanding? What kinds of stereotypical pictures do the students think people in other parts of the nation and world might have about them?

EXTENDING THE ACTIVITY:

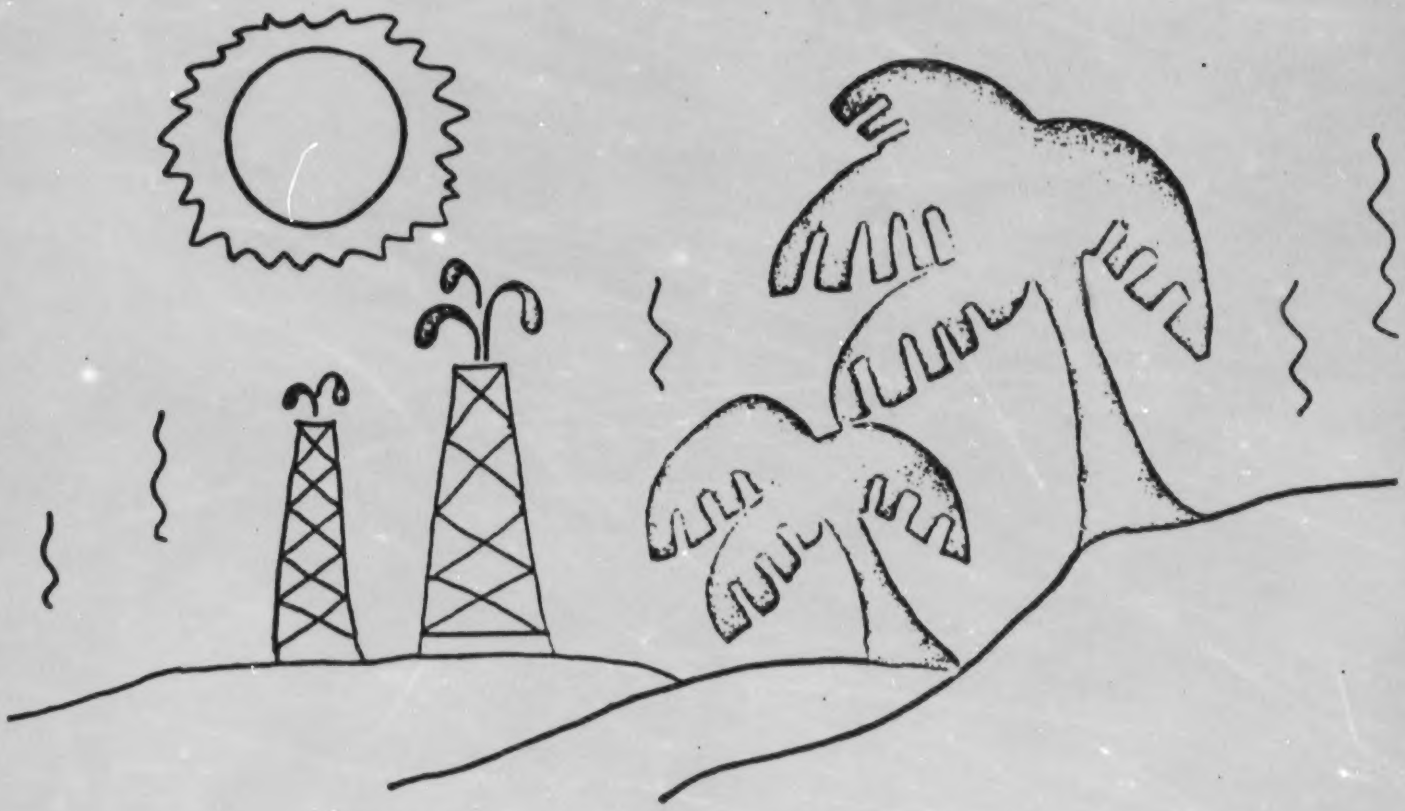
1. Collect and make a bulletin-board display of cartoons, photographs, advertisements, and photographs that present stereotypical pictures of people and places.

2. Keep a class log of examples of stereotypes that appear in television programs. If a TV series repeatedly presents stereotypical images, suggest that the students write letters (or a collective letter) to the network protesting this practice and explaining why stereotypes are destructive.

HANDOUT A

WHERE IN THE WORLD IS THIS?

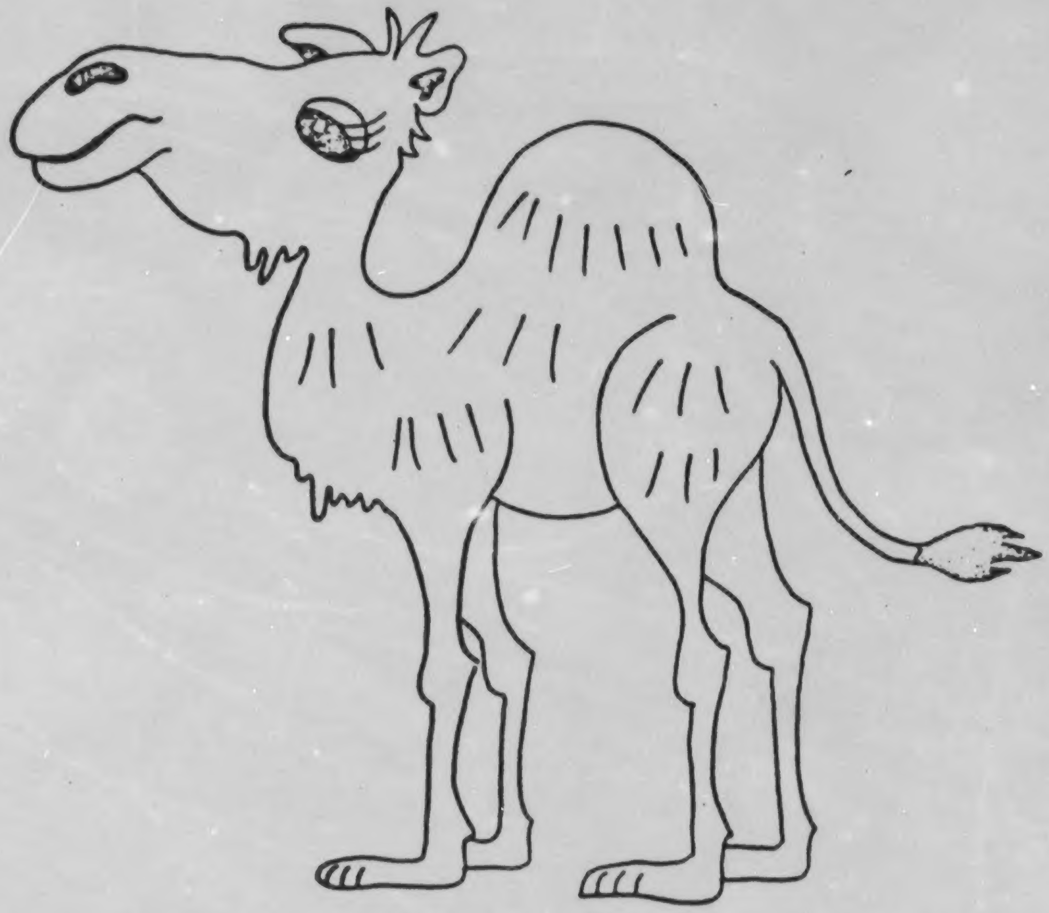
Drawing #1



HANDOUT A

WHERE IN THE WORLD IS THIS?

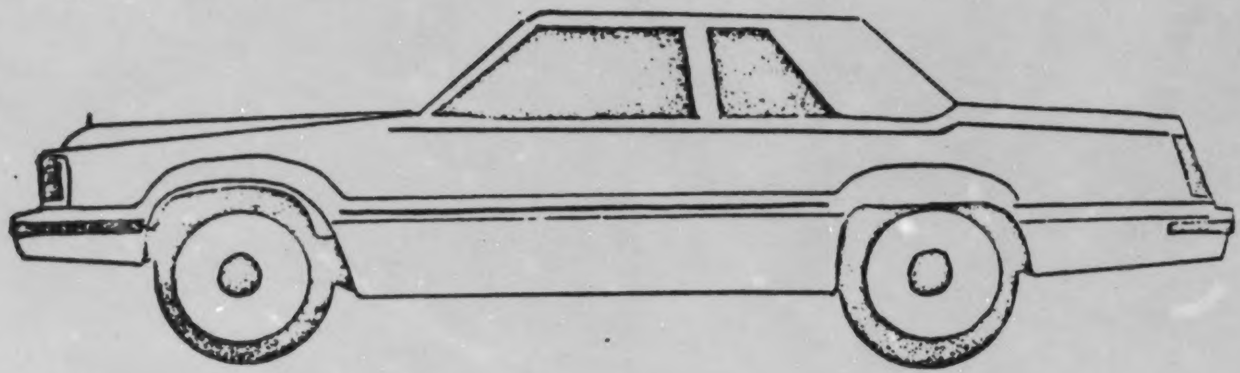
Drawing #2



HANDOUT A

WHERE IN THE WORLD IS THIS?

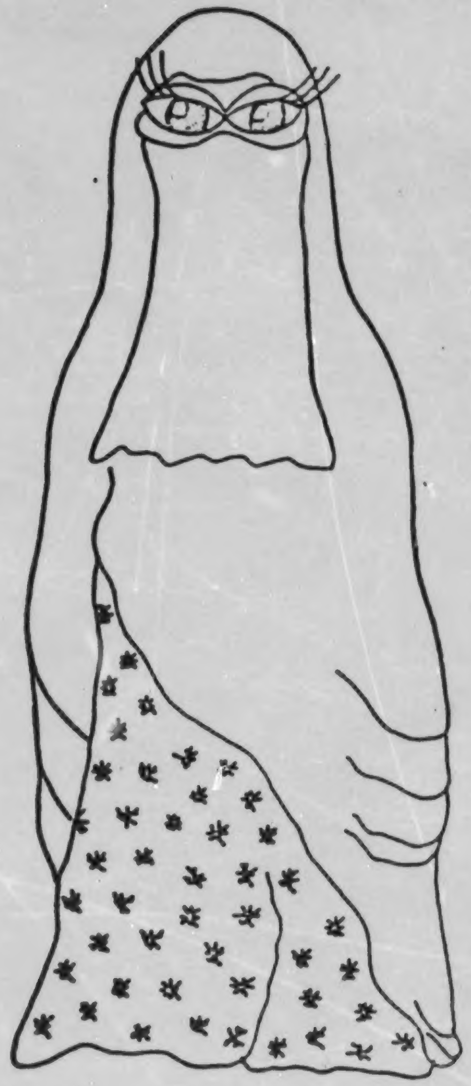
Drawing #3



HANDOUT A

WHERE IN THE WORLD IS THIS?

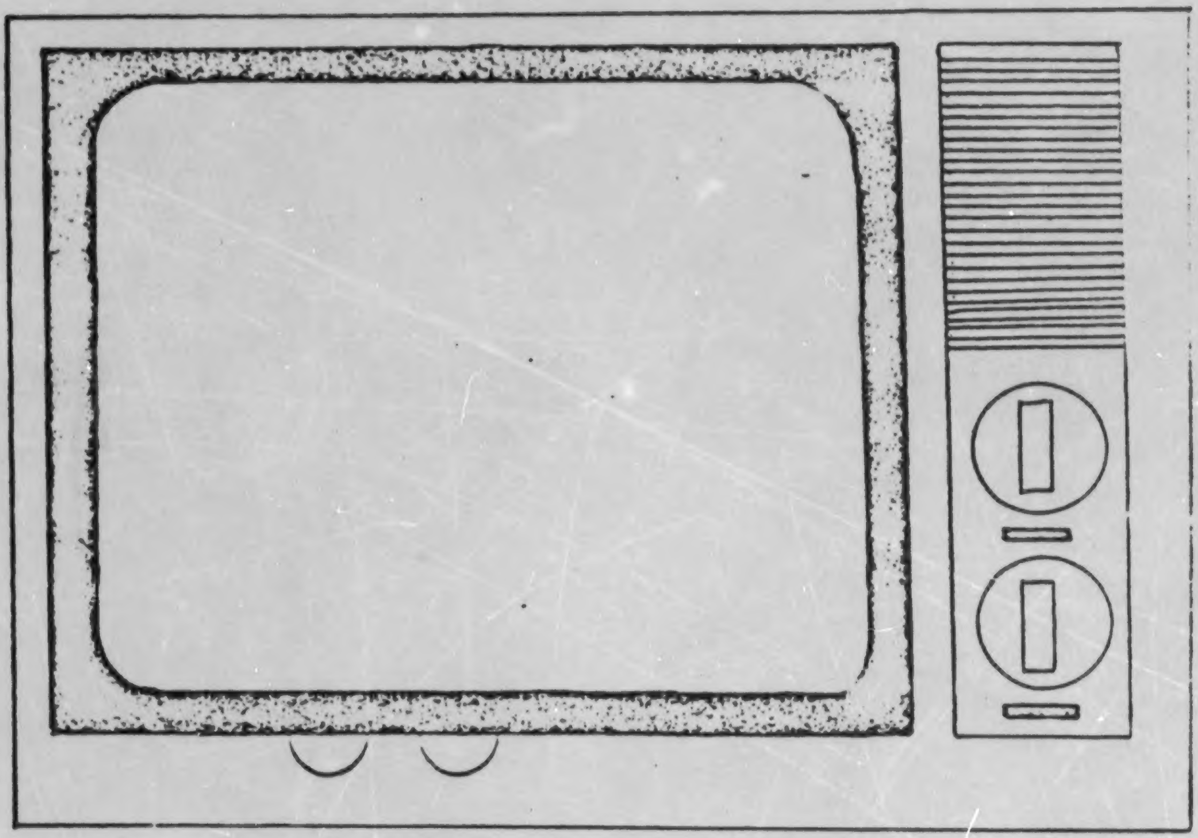
Drawing #4



HANDOUT A

WHERE IN THE WORLD IS THIS?

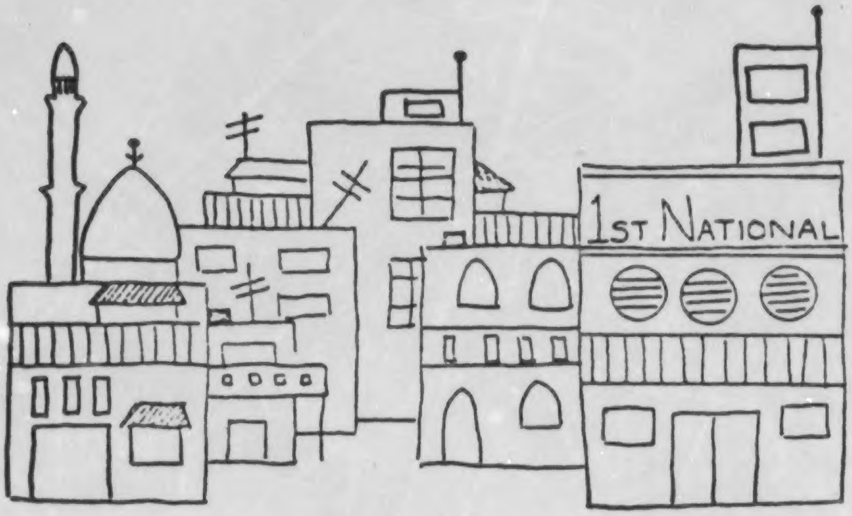
Drawing #5



HANDOUT A

WHERE IN THE WORLD IS THIS?

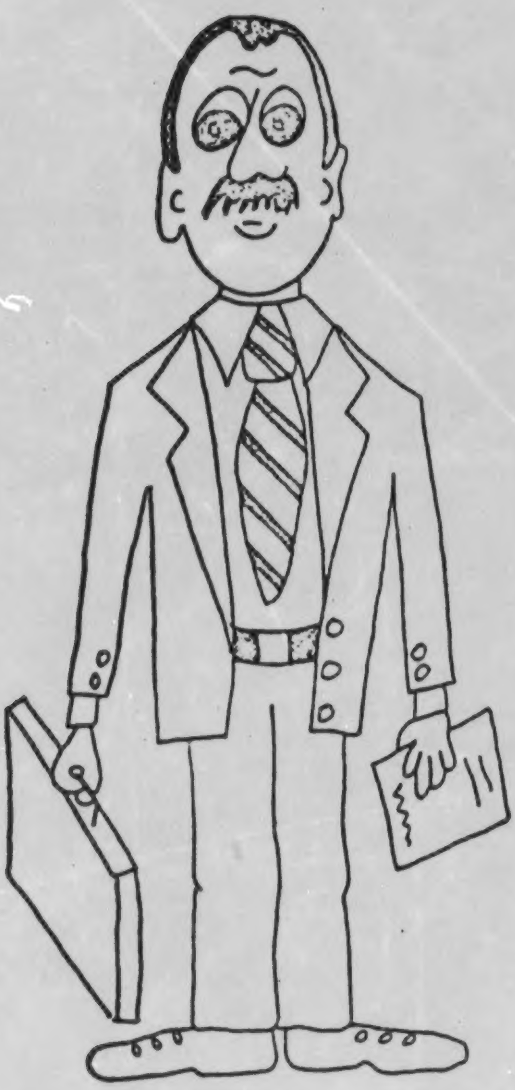
Drawing #6


1ST NATIONAL

HANDOUT A

WHERE IN THE WORLD IS THIS?

Drawing #7



HANDOUT B

WHERE IN THE WORLD IS THIS? WORKSHEET

Picture #	What Does It Show?	Where Would You Expect to Find It?
1		
2		
3		
4		
5		
6		
7		

PURPOSE: To develop a visual and/or audio expression of global interdependence.

LEVEL: Junior - Senior high school

SUBJECT: Social Studies, Art, Creative Writing

CONCEPT: Expressions of the concept of global interdependence can vary widely.

REFERENCE: Victor and Kraft, 1976, pp. 10-11.

ACTIVITY:

1. Students, individually or as groups of not more than four, are to develop a visual and/or audio expression of global interdependence. This can be done as a catalog of poetry, songs, quotations, and/or pictures; a slide show; a slide-tape show; posters; videotape; films; headlines; newsmagazine materials; charts; or whatever approach is deemed appropriate. The presentation might be sparked by a statement such as: "When I think of global interdependence, I think of..." or "To me, the term global interdependence means...".

2. As a group, critically analyze each expression to determine similarities and differences among the groups. Allow each group to explain their expression, and create an atmosphere where open feedback can occur.

3. When the critical analysis has been completed, have the students present their expressions to an elementary class. The teacher should make the initial contact with the elementary school. Or, the teacher may choose to approach a civic club or other adult group. The students should make their own arrangements with the appropriate individual teacher or leader. The students should discuss with their teacher how they might structure their presentation.

PURPOSE: To explore the ways in which multinational corporations influence our lives.

LEVEL: Junior - Senior high school - Adult

SUBJECT: Social Studies

CONCEPT: The United States is linked to other countries through a network of private business and trade.

REFERENCE: Johnson and Benegar, 1981, pp. 43-45; based on an idea developed by Global Perspectives in Education.

MATERIALS: Copies of Handout (Corporations Around the World) for each group of 3 or 4 participants.

ACTIVITY:

1. Divide the group into small groups of 3 or 4 participants each. Give a copy of the handout (Corporations Around the World) to each group. Explain that the participants should look at each brand name in the left-hand column, identify the type of product associated with that brand name, and guess the country in which its headquarters or parent company (owner) is based. Allow 10 or 15 minutes for the groups to fill in their handouts.

2. Read each brand name and ask the groups to report their answers orally. Record the answers on the chalkboard. When all answers have been reported, write the correct answers on the chalkboard or star any correct answers that were reported. (See Leader's Worksheet for correct answers.)

3. Ask whether participants notice anything unusual about the correct answers. (None of the companies have corporate headquarters in the United States.) What were their reasons for guessing that the headquarters of some of these companies are located in the United States? (All these brand names are familiar to consumers in the United States.)

4. Point out that these brand names are just a few examples of many thousands of products which are sold all over the world. Such products may be made by relatively small companies or by huge corporations that have manufacturing plants in many different countries. Ask participants to suggest some names or terms that might be used to describe such companies.

5. Write the term "multinational corporation" on the chalkboard. Explain that this is the term most commonly used to refer to companies that produce and/or sell goods or services in more than one country. (This may not be necessary for older groups.)

6. Ask the participants to look around the room for evidence that other items were produced by multinational corporations. You may need to suggest that they look at the title pages of books (many publishers have offices in more than one country), at labels on clothing or backpacks, and at various kinds of other items--for example, maps, globes, bulletin boards, notebooks, pencils, audiovisual equipment, and furniture--which

may be stamped or printed with the names of countries in which they are made. Ask each participant to start a list of such items and add to it during the rest of the day.

DISCUSSION:

1. What advantages might multinational corporations have?
2. What problems might these corporations create?
3. What impact might multinational corporations have on the environment? Why? (Food production is one area where multinational management has a heavy impact on local environments.)
4. How do the products you buy at the store relate to multinational corporations and their impact on the world environment?
5. What changes might you be able to bring about by purchasing selectively? Do these actions matter in the long term?

EXTENDING THE ACTIVITY:

1. Ask participants to look through magazines and newspapers for advertisements of products from foreign countries which are sold in the United States. Make a bulletin-board display of these ads and add to it throughout the remainder of the semester or year.
2. Post a large map of the world. Ask participants to collect examples of products, or advertisements for products, sold in the United States which were made in other countries. Mark each country with a pushpin or sticker. Ask the participants to locate as many different countries as possible. (To motivate participation, you might set a goal before beginning this project--for example, products from 50 different countries. Keep track of the total and add to it as new countries are identified.) When you decide to stop collecting examples, mark your home community with a pushpin or sticker and use yarn or colored string to connect it with all the other pushpins or stickers.

CORPORATIONS AROUND THE WORLD

Directions: Working as a group, write down the type of product that you associate with each brand name and then guess where (in which country) the company's headquarters is located.

Brand Name	Product(s)	Country
Shell		
Baskin-Robbins		
Nestle		
Bayer		
Michelin		
Pepsodent		
Timex		
Lipton		
Sony		
Magnavox		
Bic		
Bantam		
Stouffer		
American Motors		
Progresso		
Adidas		

LEADER WORKSHEET

CORPORATIONS AROUND THE WORLD

Brand Name	Product(s)	Country
Shell	oil/gasoline	Netherlands
Baskin-Robbins	ice cream	Great Britain
Nestle	chocolate/candy	Switzerland
Bayer	aspirin	West Germany
Michelin	tires	France
Pepsodent	toothpaste	Netherlands
Timex	watches	Norway
Lipton	tea/soups	Great Britain
Sony	television/radio/tape player	Japan
Magnavox	television	Netherlands
Bic	pens	France
Stouffer	food/restuarants	Switzerland
American Motors	automobiles	France (Renault)
Progresso	foods	Canada
Adidas	shoes/clothing	West Germany

PURPOSE: To rank-order alternatives regarding global problems according to individual value preferences.

LEVEL: Junior - Senior high school - Adult

SUBJECT: Social Studies

CONCEPT: Many issues require more thoughtful consideration than they are often given.

REFERENCE: Victor and Kraft, 1976, pp. 33-36.

MATERIALS: Copies of Handout (Global Alternatives) (optional; can be read aloud to class)

ACTIVITY:

1. Present participants with a question and three or four alternatives for responding to it. Ask them to rank-order these responses according to their own value preference.

2. After participants have completed each question (or after they have completed all the questions given), ask five or ten individuals to present their rankings to the group. (Allow participants to "pass" if they prefer not to share their rankings.) You may also wish to present your own ranking for each question.

DISCUSSION:

1. In groups, or as a whole, give all participants the opportunity to present their rank orders and explain the various reasons for their choices.

NOTE: It is important that the teacher remember that not all opinions are of equal "worth."

For example, the student who claims that the energy shortage does not constitute an area of concern because there is no shortage, and gives as his/her source parents who believe that the recent shortage was simply manipulation by the oil countries, has less valid support for his/her position than a student holding the same belief but giving as his/her grounds a report published by the Federal Energy Administration. In other words, the primary goal of these activities is to get students to surface and test the bases for their beliefs rather than simply finding out how many students prefer which alternatives. A more complete description of this process can be found in the following works, among others: Ehman, Mehlinger and Patrick, Toward Effective Instruction in Secondary Social Studies (Houghton Mifflin, 1974) pp. 256-295; Hunt and Metcalf, Teaching High School Social Studies (Harper and Row, 1968) pp. 120-144; Massialas and Cox, Inquiry in Social Studies (Little, Brown and Co., 1970) entire volume.

GLOBAL ALTERNATIVES

Which of the following global problems is most important?

- food shortage
- energy shortage
- air pollution (or water pollution)
- population increase

If you could eliminate a global problem in the next ten years, what would it be?

- food shortage
- air pollution (or water pollution)
- energy shortage
- population increase

Where would you most like to live?

- India
- Nigeria
- Honduras
- China

What do you feel the United States policy should be toward the world's underdeveloped countries?

- Let them make it on their own
- Help them by giving or selling them grain
- Help them by giving or selling them technical assistance
- Help them only if they agree to some form of population control

What should our country's goals be for the 1980's?

- Become energy self-sufficient
- Achieve zero population growth
- Help other world nations modernize
- Help feed the 400 to 500 million children suffering from malnutrition by giving large amounts of grain to needy countries
- Do everything we can to help promote global peace

Which of the following exerts the greatest single threat to world peace?

- the Mideast situation
- The shortage of oil and natural gas
- Mass starvation
- The proliferation of nuclear weapons

If you lived in an underdeveloped country, which would you rather do?

- Work as a salesperson at an outdoor market in a crowded city
- Work at a hospital in a crowded city
- Work as a hand-laborer on a farm you did not own
- Work as a school teacher in a rural village

In a developed country, which would you rather do?

- -- Work as a salesperson in a retail chain store
- -- Work at a hospital in a crowded city
- -- Work as a laborer on a farm you did not own
- -- Work as a school teacher in an inner city neighborhood
- -- Become a social worker in a poverty stricken area

Which is most important to you?

- -- National security
- -- The development of "cheap" forms of energy
- -- A new type of hybrid seed which would increase grain production 10%
- -- The complete destruction of nuclear weapons

ENDANGERED SPECIES

PURPOSE: To become familiar with endangered and threatened species in participants' own state.

LEVEL: Upper elementary

SUBJECT: Social Studies, Language Arts

CONCEPT: All 50 states have endangered or threatened species.

REFERENCE: U.S. Department of the Interior, 1980, Lesson Plan 3

MATERIALS: List of endangered or threatened species in the United States (Data Sheet), name of the agency, department or person responsible for endangered species management in your state.

ACTIVITY:

1. Review with the group the meaning of the terms "endangered species," "threatened species," and "critical habitat." Ask the participants why they think species become endangered. Is there a local example of habitat loss? What species are losing the areas in which they live? Are any of those species endangered?

2. Ask the participants whether they know of any endangered species in the State. What do they think are some reasons contributing to the endangerment of the species in their State?

   Distribute the Data Sheets and ask the participants to see whether the species names are on the list. If they are not listed, discuss possible reasons. If they are listed, circle the species.

3. Discuss ways in which information about the species can be collected.

4. Discuss with the group the proper business letter form. Organize the group into teams. Instruct each team to compose a letter to an individual (local or State) who has endangered species responsibility. The letter should request specific information on a particular species in your State. Names, population data, State efforts, and recovery or management techniques should be requested. The letter might also request specific information on species that at one time lived in your State but are now extinct. Some letters should be written to private businesses or professional organizations requesting information on their feelings about and responsibilities to endangered species (e.g., State Chamber of Commerce, a timber company in your State, or local Audubon Society). Caution: It is best not to inundate one person with requests for the same or similar information. If a number of letters are addressed to one person, restructure one letter to obtain the requested information for all, or enclose all the letters in one envelope.

5. Mail the letters and wait for responses. As the responses arrive, share them with the group. After a number have been received, have the group organize and discuss the data. Participants might write reports or stories on the management techniques used to help one endangered species recover in their State.

DISCUSSION:

1. What is the significance for the world environment of State policies and management techniques regarding protection of endangered species? Do State actions make a difference?

2. What can individuals do to help protect endangered species?

NOTE:

The responsibility for endangered species management varies from state to state. Some possibilities for researching where the responsibility lies in your State include:

1. Telephone listings under "United States Government, Department of Interior, Fish and Wildlife Service."
2. Local fish/wildlife law enforcement officer or game warden.
3. Local or State Chamber of Commerce
4. Local or State Audubon Society
5. Other environmental organizations
6. Industrial organizations
7. County Extension Agent
8. Department of Natural Resources, Department of Fish and Game, or other State agency responsible for wildlife resources

NOTE:

An optional quiz is included and can be used as a follow-up activity. Quiz answers:

1. b. The Endangered Species Act applies to plants and animals that are in danger of becoming extinct. You might point out that the Act also applies to plants and animals that are likely to become endangered in the foreseeable future if not protected.

2. Answers will vary depending upon your State. All 50 States have at least one listed species.

3. Answers will vary according to the State and species. State agencies would include those responsible for fish and wildlife resources and perhaps plant resources. All Federal agencies are required to carry out their activities without jeopardizing the survival of any listed endangered species. Depending upon species, actual protection responsibility is lodged with one of three agencies: the U.S. Fish and Wildlife Service (Department of the Interior), the National Marine Fisheries Service (Commerce Department), or the Animal and Plant Inspection Service (U.S. Department of Agriculture).

4. Answers will vary depending upon your State.

DATA SHEET

LIST OF ENDANGERED AND THREATENED WILDLIFE AND PLANTS NATIVE TO THE UNITED STATES (AND TERRITORIES)*

How many endangered species and threatened species of plants and animals live in your State? Look through this list and count them. Maybe you can help in the effort to preserve endangered species in your State. Write a letter and find out!

(E) Endangered Species
(T) Threatened Species

FISHES

Pahranagat Bonytail (E) NV
Alabama Cavefish (T) AL
Bonytail Chub (E) AZ, CA, CO, NV, UT, WY
Humpback Chub (E) AZ, CO, UT, WY
Mohave Chub (E) CA
Slender Chub (T) TN, VA
Spotfin Chub (T) AL, GA, NC, TN, VA
Longjaw Cisco (E) Lakes Michigan, Huron, and Erie
Cui-ui (E) NV
Kendall Warm Springs Dace (E) WY
Moapa Dace (E) NV
Bayou Darter (T) MS
Fountain Darter (E) TX
Leopard Darter (T) AR, OK
Maryland Darter (E) MD
Okaloosa Darter (E) FL
Slackwater Darter (T) AL, TN
Snail Darter (E) TN
Watercress Darter (D) AL
Big Bend Gambusia (E) TX
Clear Creek Gambusia (E) TX
Goodenough Gambusia (E) TX
Pecos Gambusia (E) NM, TX
Pahrump Killifish (E) NV
Scioto Madtom (E) OH
Yellowfin Madtom (T) GA, TN, VA
Blue Pike (E) Lakes Erie and Ontario
Comanche Springs Pupfish (E) TX
Devil's Hole Pupfish (E) CA
Owens River Pupfish (E) CA
Tecopa Pupfish (E) CA
Warm Springs Pupfish (E) NV
Colorado River Squawfish (E) AZ, CA, CO, NM, NV, UT, WY
Unarmored Threespine Stickleback (E) CA
Shortnose Sturgeon (E) CT, DE, GA, FL, MA, MD, ME, NC, NH, NJ, NY, PA, RI, SC, VA
Gila Topminnow (E) AZ, NM
Arizona Trout (T) AZ

Gila Trout (E) NM
Greenback Cutthroat Trout (T) CO
Lahontan Cutthroat Trout (T) CA, NV
Little Kern Golden Trout (T) CA
Paiute Cutthroat Trout (T) CA
Woundfin (E) AZ, NV, UT

REPTILES AND AMPHIBIANS
American Alligator (E) AL, AR, GA, LA, MS, NC, OK, SC, TX
American Alligator (T) FL, GA, LA, SC, TX
Culebra Giant Anole (E) Puerto Rico: Culebra Island
Mona Boa (T) Puerto Rico: Mona Island
Puerto Rico Boa (E) Puerto Rico
Virgin Island Tree Boa (E) U.S. Virgin Islands
Golden Coqui (T) Puerto Rico
American Crocodile (E) FL
Mona Ground Iguana (T) Puerto Rico: Mona Island
Blunt-nosed Leopard Lizard (E) CA
Island Night Lizard (T) CA
St. Croix Ground Lizard (E) U.S. Virgin Islands
New Mexican Ridge-nosed Rattlesnake (T) NM
Desert Slender Salamander (E) CA
Red Hills Salamander (T) AL
Santa Cruz Long-toed Salamander (E) CA
Texas Blind Salamander (E) TX
Atlantic Salt Marsh Snake (T) FL
Eastern Indigo Snake (T) AL, FL, GA, MS, SC
San Francisco Garter Snake (E) CA
Houston Toad (E) TX
Pine Barrens Tree Frog (E) FL
Kemp's (Atlantic) Ridley Sea Turtle (E) Tropical and temperate seas
Green Sea Turtle (T) Tropical and temperate seas
Green Sea Turtle (E) FL
Hawksbill (Carey) Sea Turtle (E) Tropical seas
Leatherback Sea Turtle (E) Tropical, temperate, and subpolar seas
Loggerhead Sea Turtle (T) Tropical and temperate seas
Olive (Pacific) Ridley Sea Turtle (T) Tropical and temperate seas
Plymouth Red-belled Turtle (E) MA

SNAILS
Chittenango Ovate Amber Snail (T) NY
Flat-Spired Three-toothed Snail (T) WV
Iowa Pleistocene Snail (E) IA
Noonday Snail (T) NC
Painted Snake Coiled Forest Snail (T) TN
Stock Island Snail (T) FL
Virginia Fringed Mountain Snail (E) VA

CLAMS
Alabama Lamp Pearly Mussel (E) AL, TN
Appalachian Monkeyface Pearly Mussel (E) TN, VA
Birdwing Pearly Mussel (E) TN, VA

Cumberland Bean Pearly Mussel (E) KY
Cumberland Monkeyface Pearly Mussel (E) AL, TN, VA
Curtis' Pearly Mussel (E) MO
Dromedary Pearly Mussel (E) TN, VA
Green-blossom Pearly Mussel (E) TN, VA
Higgins' Eye Pearly Mussel (E) IA, IL, MN, MO, NE, WI
Orange-footed Pearly Mussel (E) AL, IA, IN, KY, OH, PA, TN
Pale Lilliput Pearly Mussel (E) AL, MO, TN, WV
Pink Mucket Pearly Mussel (E) AL, IL, IN, KY, MO, OH, PA, TN, WV
Sampson's Pearly Mussel (E) IL, IN
Tubercled-blossom Pearly Mussel (E) IL, KY, TN, WV
Turgid-blossom Pearly Mussel (E) AL, AR, MO, TN
White Cat's Eye Pearly Mussel (E) IN, MI, OH
White Wartyback Pearly Mussel (E) AL, TN
Yellow-blossom Pearly Mussel (E) AL, TN
Fine-rayed Pigtoe (E) AL, TN, VA
Rough Pigtoe (E) KY, TN, VA
Shiny Pigtoe (E) AL, TN, VA
Fat Pocketbook (E) AR, IN, MO, OH
Tan Riffle Shell Clam (E) KY, TN, VA

INSECTS
Bahama Swallowtail Butterfly (T) FL
El Segundo Blue Butterfly (E) CA
Lange's Metalmark Butterfly (E) CA
Lotis Blue Butterfly (E) CA
Mission Blue Butterfly (E) CA
San Bruno Elfin Butterfly (E) CA
Schaus Swallowtail Butterfly (T) FL
Smith's Blue Butterfly (E) CA
Kern Primrose Sphinx Moth (T) CA

CRUSTACEANS
Socorro Isopod (E) NM

PLANTS
Bunched Arrowhead (E) NC, SC
Tennessee Purple Coneflower (E) TN
Lipochaeta venosa (E) HI
Trukee Barberry (E) CA
Virginia Round-leaf Birch (E) VA
McDonald's Rock-cress (E) CA
Contra Costa Wallflower (E) CA
Tobusch Fishhook Cactus (E) TX
Nellie Cory Cactus (E) TX
Bunched Cory Cactus (T) TX
Lee Pincushion Cactus (T) NM
Sneed Pincushion Cactus (E) NM, TX
Nichol's Turk's Head Cactus (E) AZ
Kuenzler Hedgehog Cactus (E) NM
Lloyd's Hedgehog Cactus (E) TX
Purple-spined Hedgehog Cactus (E) UT
Black Lace Cactus (E) TX

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Arizona Hedgehog Cactus (E) AZ
Spineless Hedgehog Cactus (E) CO, UT
Davis' Green Pitaya (E) TX
Lloyd's Mariposa Cactus (T) TX
Brady Pincushion Cactus (E) AZ
Knowlton Cactus (E) NM
Peebles Navajo Cactus (E) AZ
Siler Pincushion Cactus (E) AZ, UT
Uinta Basin Hookless Cactus (T) CO, UT
Mesa Verde Cactus (T) DO, NM
Wright Fishhook Cactus (E) UT
Santa Barbara Island Liveforever (E) CA
Raven's Manzanita (E) CA
Chapman Rhododendron (E) FL
Rydberg Milk-vetch (T) UT
Hairy Rattleweed (E) GA
San Clemente Broom (E) CA
Hawaiian Wild Broad-bean (E) HI
Phacelia argillacea (E) UT
Haplostachys haplostachya var. angustifolia (E) HI
San Diego Mesa Mint (E) CA
Stenogyne angustifolia var. angustifolia (E) HI
Harper's Beauty (E) FL
Persistent Trillium (E) GA, SC
Cooke's Kokio (E) HI
San Clemente Island Bushmallow (E) CA
MacFarlane's Four-o-clock (E) ID, OR
Eureka Eveningprimrose (E) CA
Antioch Dunes Eveningprimrose (E) CA
Dwarf Bear-poppy (E) UT
Crampton's Orcutt Grass (E) CA
Eureka Dune Grass (E) CA
Texas Wild Rice (E) TX
Northern Wild Monkshood (T) IA, NY, OH, WI
San Clemente Island Larkspur (E) CA
Green Pitcher Plant (E) AL, GA
San Clemente Island Indian Paintbrush (E) CA
Salt Marsh Bird's Beak (E) CA
Furbish Lousewort (E) ME

BIRDS
Hawaii Akepa (honeycreeper) (E) HI
Maui Akepa (honeycreeper) (E) HI
Kuai Akialoa (honeycreeper) (E) HI
Akipolaau (honeycreeper) (E) HI
Yellow-shouldered Blackbird (E) Puerto Rico
Masked Bobwhite (Quail) (E) AZ
California Condor (E) CA, OR
Hawaiian Coote (E) HI
Mississippi Sandhill Crane (E) MS
Whooping Crane (E) CO, ID, KS, MT, NE, ND, NM, OK, SD, TX, UT, WY
Hawaiian Creeper (E) HI
Molokai Creeper (Kakawahie) (E) HI
Oahu Creeper (alauwahio) (E) HI

Hawaiian Crow (alala) (E) HI
Eskimo Curlew (E) AK
Palau Ground Dove (E) Palau Islands
Hawaiian Duck (koloa) (E) HI
Laysan Duck (E) HI
Bald Eagle (E) Lower 48 states other than MI, MN, OR, WA, WI
Bald Eagle (T) MI, MN, OR, WA, WI
American Peregrine Falcon (E) AK, all Lower 48 states
Arctic Peregrine Falcon (E) AK, all Lower 48 states
Laysan Finch (honeycreeper) (E) HI
Nihoa Finch (honeycreeper) (E) HI
Palau Fantail Flycatcher (E) Palau Islands
Tinian Monarch Flycatcher (E) Marianas Islands
Hawaiian Gallinule (E) HI
Aleutian Canada Goose (E) AK, CA, OR, WA
Hawaiian Goose (Nene) (E) HI
Hawaiian Hawk (I) (E) HI
Crested Honeycreeper (akohekohe) (E) HI
Everglade Kite (E) FL
Marianas Mallard (E) Marianas Islands, Guam
LaPerouse's Megapode (E) Palau Islands, Marianas Islands
Nihoa Millerbird (E) HI
Kauai Oo (Oo Aa) (honeyeater) (E) HI
Ou (honeycreeper)(E) HI
Palau Owl (E) Palau Islands
Palila (honeycreeper) (E) HI
Puerto Rican Parrot (E) Puerto Rico
Maui Parrotbill (honeycreeper) (E) HI
Brown Pelican (E) AL, CA, FL, GA, LA, MS, NC, SC, TX
Hawaiian Dark-rumped Petrel (E) HI
Puerto Rican Plain Pigeon (E) Puerto Rico
Poo-uli (E) HI
Attwater's Greater Prairie Chicken (E) TX
California Clapper Rail (E) CA
Light-footed Clapper Rail (E) CA
Yuma Clapper Rail (E) AZ, CA
Newell's Manx Shearwater (T) HI
San Clemente Loggerhead Shrike (E) CA
Cape Sable Seaside Sparrow (E) FL
Dusky Seaside Sparrow (E) FL
San Clemente Sage Sparrow (T) CA
Santa Barbara Song Sparrow (E) CA
Ponape Mountain Starling (E) Caroline Islands
Hawaiian Stilt (E) HI
California Least Tern (E) CA
Large Kauai Thrush (E) HI
Molokai Thrush (olomau) (E) HI
Small Kauai Thrush (puaiohi) (E) HI
Bachman's (wood) Warbler (E) AL, AR, FL, GA, KY, LA, MO, MS, NC, SC, TN
Kirtland's Warbler (E) MI
Reed Warbler (E) Marianas Islands
Puerto Rican Whip-poor-will (E) Puerto Rico
Ponape Great White-eye (E) Caroline Islands

Ivory-billed Woodpecker (E) AL, AR, FL, GA, IL, IN, KY, LA, MO, MS, NC, OK, SC, TN, TX
Red-cockaded Woodpecker (E) AL, AR, FL, GA, KY, LA, MD, MO, MS, NC, OK, SC, TN, TX, VA

MAMMALS
Gray Bat (E) AL, AR, KY, MO, OK, TN
Hawaiian Hoary Bat (E) HI
Indiana Bat (E) AL, AR, CT, FL, IL, IN, IA, KS, KY, MA, MD, MI, MO, MS, NC, NH, NJ, NY, OH, PA, RI, SC, TN, VA, VT, WI, WV
Ozark Big-eared Bat (E) AR, MO, OK
Virginia Big-eared Bat (E) IL, IN, KY, OH, VA, WV
Brown or Grizzly Bear (T) CO, ID, MT, WY
Eastern Cougar (E) Eastern North America
Columbia White-tailed Deer (E) OR, WA
Key Deer (E) FL
Dugong (E) U.S. Trust Territories
Black-Footed Ferret (E) CO, KS, ND, NE, OK, SD, TX, WY
San Joaquin Kit Fox (E) CA
Jaguar (E) AZ, NM, TX
Jaguarundi (E) AZ, TX
West Indian (Florida) Manatee (E) AL, FL, GA, LA, MS, NC, SC
Salt Marsh Harvest Mouse (E) CA
Southern Sea Otter (T) CA, OR, WA
Florida Panther (E) AL, AR, FL, GA, LA, MS, SC
Utah Praire Dog (E) UT
Sonoran Pronghorn (E) AZ
Morro Bay Kangaroo Rat (E) CA
Caribbean Monk Seal (E) FL, LA, TX
Hawaiian Monk Seal (E) HI
Delmarva Peninsula Fox Squirrel (E) DE, MD, PA, VA
Blue Whale (E) Oceanic
Bowhead Whale (E) Oceanic
Finback Whale (E) Oceanic
Gray Whale (E) Oceanic
Humpback Whale (E) Oceanic
Right Whale (E) Oceanic
Sei Whale (E) Oceanic
Sperm Whale (E) Oceanic
Gray Wolf (E) Lower 48 States other than MN
Gray Wolf (T) MN
Red Wolf (E) AR, KY, LA, MO, MS, TN, TX

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*Compiled by U.S. Fish and Wildlife Service, 1980.

QUIZ

1. Circle the best definition for the term "endangered species."
    a. Any species that is likely to become endangered.
    b. Any species that is in danger of becoming extinct.
    c. Any species that has become extinct.

2. Identify two endangered species that are listed in your State.

3. List three agencies (State or Federal) that are responsible for managing endangered species in your State.

4. List three places (or people) other than libraries where you would go to find out about endangered species in your state.

PURPOSE: To understand the importance of habitat protection as it relates to endangered species.

LEVEL: Upper elementary - Junior high school

SUBJECT: Social Studies, Environmental Studies, Art

CONCEPT: Organisms need places to live, find food and carry on all other life-sustaining functions.

REFERENCE: U.S. Department of the Interior, 1980, Lesson Plan 1

MATERIALS: Data Sheets for each participant, pencils, colored pencils or felt-tipped markers

ACTIVITY:

1. Take a short discovery walk around the schoolyard or meeting area. Let the participants quietly point out plants, insects, birds, and other animals. Observe the organisms and discuss with the participants the things living organisms need in order to survive (e.g., food, water, air, shelter). Hypothesize how the site might meet the needs of observed organisms. Discuss the dangers the organisms must face in their environment.

2. Return to the classroom and review what was seen and discussed. Introduce the concept of critical habitat. Ask the participants what they believe would happen to an organism if an essential part of its critical habitat were destroyed. If an organism or species is to survive in a changing environment, it must change its behavior or structure (evolutionary change). If an organism does not change (adapt), it will die.

3. Discuss with the group that adaptive changes (structural or behavioral) in any species take many generations to accomplish. The animal or plant that can live in the most diverse habitat has the best chance of survival.

4. Distribute the Data Sheets. Ask the students to create an imaginary organism called the "planmal." The task is for the participants to create a cartoon story about the planmal's fight for survival in a changing environment. A sample cartoon follows this activity.
   a. In Frame #1 of the Data Sheet, draw a descriptive picture of the planmal. Write a short description of the organism and its lifestyle, needs and environment.
   b. Frames #2 to #5 (or more if desired; provide additional Data Sheets) should show and discuss habitat changes and the way in which the planmal copes with those changes. Encourage participants to use their imaginations, but emphasize behavioral (life-style) adaptations that are possible in one generation rather than long-term structural changes (e.g., it would take eons for a land species to become truly aquatic and evolve flippers in place of legs).
   c. Drawings might be done in pencil first and later "dressed up" with felt-tipped markers.

5. Share the completed cartoons with the group through a show-and-discuss format or a bulletin board display.

DISCUSSION:

1. The following points should be brought out in discussion of the completed cartoons:

    a. The planmal does not exist;
    b. Habitat destruction is the leading threat to species survival;
    c. In most cases, major adaptations in a plant or animal population occur over long periods of time. Individual organisms cannot adapt to dramatic changes in their environment overnight.
    d. Because adaptations take many generations to perfect in nature, the threatened species may well become extinct before such adaptive processes can come about.

2. Would the organisms found by the participants on the discovery walk continue to live if essential parts of their critical habitat are destroyed? Could these organisms adapt and survive? Which organisms are most likely to survive moderate changes in habitat? (Dandelion, house sparrow, and gray squirrel are good examples).

3. What impact might the destruction of critical habitat in one area have on the rest of the world? What are some of the problems related to allowing a species to become extinct? What responsibilities do people have to prevent species from becoming extinct?

EXTENDING THE ACTIVITY:

Following the discussion about the cartoons, including the fact that some of the things depicted do not really happen, ask participants to draw a second cartoon reflecting more realistic behavior.

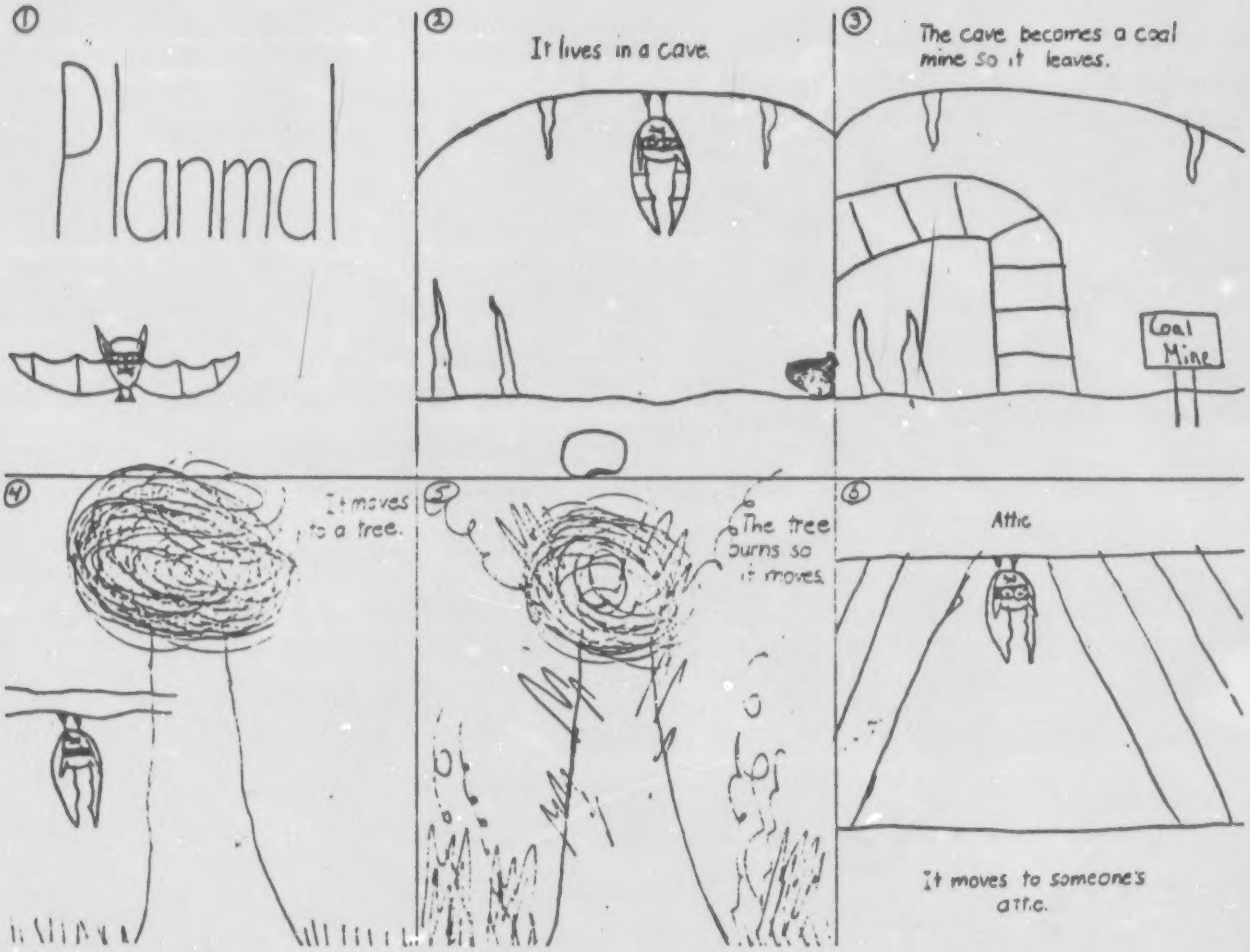
NOTE:

An optional quiz is included that can be used as follow-up to this activity. Quiz answers:

1. d is the best definition for "critical habitat." Critical habitat applies to both endangered and threatened species.
2. Experts feel that there are a number of reasons why species become endangered. Today the most serious threat to plants and animals is loss of habitat. Other reasons include: overspecialization, environmental contamination, commercial exploitation, and competition from introduced species.
3. True. In 1973, Congress passed the Endangered Species Act. Other laws, such as the Bald Eagle Protection Act of 1940, offer protection to some species. Most States have laws protecting endangered plants and animals.
4. As is true for many environmental issues, there is no one correct or incorrect answer to this question. This question should give the students an opportunity to examine their feelings concerning endangered species. It should also point out the need to analyze all aspects of an issue before a decision can be reached.

5. False. Species usually take a long time to adapt. Structural changes take a longer time than behavioral adaptations.

SAMPLE CARTOON


①
Planmal
②
It lives in a cave.
③
The cave becomes a coal mine so it leaves.
Coal Mine
④
It moves to a tree.
⑤
The tree burns so it moves.
⑥
Attic
It moves to someone's attic.

The Planmal's Story, as drawn by a seventh grader.

DATA SHEET

The Planmal's Survival

In a make-believe land not too far away lives the planmal, an organism that has always existed in large numbers. Changes occurred in that organism's habitat. The changes would have endangered most living things. The planmal had to struggle to survive but survive it did! How?

1

2

3

4

5

QUIZ

1. Circle the best definition for "critical habitat."
   a. Those places that endangered or threatened species avoid.
   b. Those places where endangered or threatened species are found.
   c. Those places that supply the needs of endangered species.
   d. Those places within the area where endangered or threatened species are found that supply the needs of the species.

2. List two reasons why species become endangered.

3. There are Federal and State laws that protect endangered species (Circle correct answer).

   True False

4. Pretend you live in a town close to a stream where some people want to build a dam. Growing in the marsh near the stream is an endangered plant. This is how people are thinking about the dam:
   a. A dam would be great! It would make a lake for boating, swimming, and fishing. It would also make needed electricity.
   b. The dam would be bad! It would flood and destroy the critical habitat of an endangered plant. The plant is pretty and might be useful to make a chemical that protects people from colds.

How would you vote: For the dam? Against the dam?

Why? Give your reasons.

5. Read this statement. Is it true or false? Circle your answer.

   "In most cases, species can quickly adapt to changes in their habitats."

   True False

PURPOSE: To build awareness of the complexity of the issue of endangered species.

LEVEL: Upper elementary - Junior high school

SUBJECT: Social Studies, Environmental Studies

CONCEPT: The issue of endangered species is controversial. Often no definite answer is obvious.

REFERENCE: U.S. Department of the Interior, 1980, Lesson Plan 2

MATERIALS: Data Sheets and pencils for each participant, newsprint or poster boards and colored markers (optional)

ACTIVITY:

1. Discuss with the group some of the positive and negative aspects associated with having an industry located in a community. For example, the taxes the company pays probably reduce homeowners' taxes. The local government, though, might have to build new schools or provide greater police and fire protection, and a number of other community services.

2. Explain that the group will be participating in a role-playing activity about the issue of an endangered species. The species is a carnivore. Allow participants to select one role in which they are most interested. They should try to think like the people they will be portraying.

3. Distribute the Data Sheets. Read through the issue and role descriptions as a group. Mention the Map of the Community (see Data Sheet) and suggest that participants use it in developing their case. Have each participant mark with an "X" their initial feelings on the attitude scale on the bottom of the second page of the Data Sheet.

4. Identify a separate space for each role group. The participants should organize themselves into groups of approximately equal size (except for the Town Council, which should be represented by five, seven, or nine individuals).

5. Provide adequate time for the participants to discuss and research their roles. This might include library research and discussions with adults and peers. If the groups need help in developing their approaches, refer to the Leader Worksheet.

6. Have each group present its argument(s) to the Town Council. Involve at least two members of each group in the presentation, and have the groups prepare visual aids to help their presentations.

7. Allow the Town Council to leave the room to discuss the arguments it has heard and to vote on the issue. At this point, ask the rest of the participants to repeat the attitude scale exercise, indicating with an "O" their present feelings about the proposed plant.

8. When the Town Council returns, it announces its decision. The reasoning behind the decision should be explained by the leader of the Council.

DISCUSSION:

1. Discuss the decision as a group. Do participants agree or disagree? Why?

2. Discuss the second attitude scale response and reasons for any changes.

3. What impacts might building this plant have on the world environment? How does endangering a species in one area affect the rest of the world?

NOTE: An optional quiz is included that can be used as follow-up to this activity. Quiz answers:

1. There are many expressed reasons for protecting species.
   Ethical - We don't have the right to consciously drive a species to extinction.
   Utilitarian - Benefits to humans. Many organisms provide people with things that are necessary (e.g., medicines).
   Stability - Some experts believe that the more different species existing in an ecosystem, the more stable is the ecosystem.
   Danger Warning - Wildlife, like the proverbial canary used by coal miners to detect poisonous gas in mine shafts, can warn us of dangerous environmental situations.
   Esthetic - It's enjoyable to see a variety of plants and animals.

2. Again, many possible answers exist. Among the reasons are:
   Economic - The value of a project might outweigh the value an endangered species provides for people.
   Personal Freedom - People's recreational and business activities should not be restricted by endangered species.
   Ecosystem Value - A species already endangered exists in too few numbers to be useful to people or other organisms.
   Ecosystem Impact - The loss of a single organism--particularly at the top of a food chain where few other creatures depend on it for their food--is likely to have little impact on the total ecosystem. (In some cases, however, this loss can have a big effect.)

3. As in question #1, there is no single correct answer. One criticism of the Endangered Species Act of 1973 concerns the act's strict habitat protection provisions. The 1978 amendment attempts to provide a means through which the value in protecting the critical habitat for a species can be compared to a project's value. The students' responses to this question might lead into a discussion of the Endangered Species Act of 1973 as amended.

4. 1-b; 2-d; 3-a; 4-c.

DATA SHEET

The Issue

Thomas' Products is seeking approval to build a second plant in Lewes. The company's existing plant does add some pollution to the air of the community. Thomas' Products is the area's largest employer and pays more taxes than any other industry. It employs 85 people now. The new plant would employ an additional 70 people.

The land on which the new plant is to be built is part of the critical habitat of an endangered species. The animal helps control rats by feeding on them. It also eats rabbits and an occasional deeer. Even though Thomas' Products owns the land, the company needs the approval of the Town Council in order to build the plant. Should the plant be built?

DATA SHEET

Town Council: Five, seven, or nine members (choose an odd number) who must decide on the issue. They have three options: Allow Thomas' Products to build the plant; forbid Thomas' Products to build the plant; propose an alternative solution.

The Town Council must consider several trade-offs; the increased taxes that the plant would pay; the money that tourists bring to the town when they use the area; the possible pollution caused by the plant; health hazards to people and wildlife; and increase in traffic with potential hazards to both people and wildlife.

Thomas' Products. This group represents the owners and workers who want to build the new plant.

Lewes Animal Protection Society (LAPS): LAPS does not want the plant built. It always supports the protection of all animals.

Lewes Outdoor Clubs Association (LOCA): LOCA is divided. Some members want the plant built, while others don't. Strong arguments are presented or both sides of the issue.

Lewes Homeowners' Association (LHA): LHA, like LOCA, is made up of some members who support building the plant, while other members of LHA are against the plant.

How do you feel?

Thomas' should be allowed to build the plant.

Don't know, but leaning toward allowing the plant to be built.

Don't know.

Don't know, but leaning toward not allowing the plant to be built.

Thomas' should not be allowed to build the plant.

LEADER WORKSHEET

TOWN COUNCIL:

All individuals on the Town Council can select specific roles for themselves, e.g., Councils are often composed of representatives from local business, schools, lawyers, economists, planners, etc. If desired, the Town Council members can evaluate their decision on the basis of how someone in their position would view the issue.

THOMAS' PRODUCTS:

The company wants to build a plant for the following reasons:

a. The company owns the land and should be able to build the new plant.
b. The new plant would provide more tax money to the town of Lewes.
c. The endangered species serves no one but itself. It's not abundant enough for many people to see. It eats the deer and rabbits that attract people--hunters and non-hunters--to the area.
d. If the new plant is not built, Thomas' Products may have to close its existing plant and move to another area (out of state) where it can enlarge its operation. This means that 95 current jobs as well as 70 new jobs will be lost. There will be less tax money coming in.

LEWES ANIMAL PROTECTION SOCIETY (LAPS):

LAPS does not want the new plant built. This group presents an argument based on the following:

a. People do not have the right to cause any living organism to become extinct.
b. If the plant is built, deer, rabbit, and mouse populations will increase to a point where those animals might begin to starve and become sick.
c. No one really knows the value of that endangered species to people, now or in the future.
d. Another building site must exist nearby. Thomas' Products just hasn't looked hard enough.

LEWES OUTDOOR CLUBS ASSOCIATION (LOCA):

The members of this group have mixed feelings about the plant.

a. The plant would provide jobs close to home.
b. The plant would not be a major polluter in the neighborhood.
c. The area where the plant is planned is used by many people for hunting, fishing, hiking, birdwatching and other forms of outdoor recreation.
d. The area where the plant is planned attracts many tourists who buy things in Lewes and rent rooms in local motels and hotels.

LEWES HOMEOWNER'S ASSOCIATION (LHA):

The members of this group are also divided about their feelings on plans of Thomas' Products to build the new plant. Their reasons:

a. This critical habitat of an endangered species is nicer to have than the new plant.
b. The new plant will increase traffic on the streets. That will mean more noise and some danger to children.
c. The plant would pay taxes and this would reduce the taxes homeowners have to pay to run the town.
d. Tourists sometimes rent rooms from local homeowners. If the new plant is built, the number of tourists will decrease.
e. The needs of the town are more important than the needs of an endangered animal.

QUIZ

1. List two reasons often given for protecting endangered species.

2. List two reasons often given for not protecting endangered species.

3. Below are four statements. Encircle the statement you agree with most.

Endangered species should always be protected.

Endangered species should only be protected if they are important to people.

Endangered species should be protected in all except a very few cases.

Endangered species should not be protected when they stand in the way of progress.

4. Draw lines to match the Lewes groups (Column A) with an argument they might have used about whether to allow Thomas' Products to build a new plant.

Column A	Column B
1. Lewes Animal Protection Society (LAPS)	a. The company owns the land and should be able to build the plant.
2. Lewes Homeowners' Association (LHA)	b. People do not have the right to cause any animal to become extinct.
3. Thomas' Products	c. The area where they would build the plant is currently used for hunting, hiking, and fishing. This recreation will be lost if the plant is built.
4. Lewes Outdoor Clubs Association (LOCA)	d. The plant would pay taxes, and this would reduce the amount of taxes homeowners must pay to run the town.

PURPOSE: To acquaint participants with: some basic life requirements of organisms; the differing tolerances among species to adapt to changes in their environment; and the ways humans influence the success of other animals.

LEVEL: Junior-Senior high school

SUBJECT: Social Studies, Science, Biology

CONCEPT: The differences within and between populations and some common life requirements are related to the survival of the populations.

MATERIALS: Copies of Data Sheets for each participant, Mystery Birds--large chart or handout for each participant.

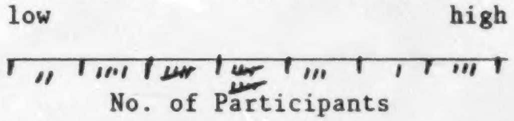
This activity is actually a set of three related activities to be completed in the order proposed.

ACTIVITY 1: Variation within a Population--What are Your Tolerances to Environmental Conditions?

1. Ask participants to individually indicate their tolerances based on their choice of optimum level of preference for each life requirement continuum on Data Sheet 1. The numbers, 1 to 7, do not indicate actual quantities, but provide a way to record a tendency on the continuum. Participants should check a number for each factor to indicate their preferences.

2. As a group, record responses to the choices. One method for compiling the information is suggested below.

TEMPERATURE: ROOM TEMPERATURE



DISCUSSION 1:

1. Discuss diversity or similarity of choices for each life requirement. For example, using the room temperature responses above, some discussion questions might be: Are all of the responses the same? What are some possible reasons for variable responses? How do individuals at either end tolerate room temperatures that are usually adjusted to the center of the continuum? Are these means of adjustment available to other animal species?

2. Keep this information for the next activity.

ACTIVITY 2: Variation Between Two Different Populations--A Hypothetical Problem

1. Divide the class into two hypothetical populations according to eye color. All participants with blue eyes or variations of blue make up one

population, and all those with brown eyes or variations of brown make up the other.

2. Assume that tolerance or adaptation of these two populations to temperature variations is narrow. The blue-eyed animal population requires a low indoor temperature and the brown-eyed animal population a high indoor temperature.

DISCUSSION 2:

1. What consequences are there for setting the temperature high? Low?

2. Should one population be allowed to survive at the expense of the other?

3. Could both populations survive? What would you do to allow for the survival of both populations?

4. What competition pressures would exist between the two populations?

ACTIVITY 3: Mystery Birds -- A Real Problem

1. Two bird populations have been selected for this activity. The Mystery Birds chart gives some important information about their life histories. Distribute copies of this chart to each participant, or place on large copy in a central visible location.

2. After reading the life history descriptions, each participant should record on Data Sheet 2 the species he or she thinks is most abundant and some reasons for their choices.

3. Tally the information from the entire group, including the number for each species along with some of the major reasons for the choices. Put this information on the blackboard or on newsprint before beginning the discussion.

DISCUSSION 3:

1. Which environment seems more stable to you? Which species would seem to demand a more stable environment? What reasons do you have for your answers?

2. Which species would seem less tolerant of human disturbance? What reasons do you have for your answers?

3. What do the feeding habits of the organisms tell you about the organism's behavior, physical appearance, its physiology, its habitat?

4. In what ways would human activities intrude on the behavior and life requirements of each organism? What are the reasons for your answers?

5. Rank order, from most important to least important, the environmental changes which would most affect each organism. (This list should be generated by the group.)

6. After discussing these questions, determine if any participants want to change their choices.

NOTE: The mystery species are identified as follows:

Mystery Species A: American Bald Eagle (Haliaeetus leucocephalus)

"Most of the remaining bald eagles nest in Canada or Alaska. Some, but not all, bald eagles migrate (if food is readily available all year, they are likely to remain near their nesting region) and many of those that are seen in the lower 48 states during the winter months are migrants from Canada. Only about 750 pairs still nest south of the Canadian border." (The Endangered Bald Eagle, Public Information Department, National Audubon Society, 950 Third Avenue, New York, NY 10022).

Mystery Species B: Redwinged Blackbird (Agelaius phoeniceus)

The redwinged blackbird, found throughout North America, may be the most numerous breeding bird on the Continent. Breeding pairs number in the 10's of millions and in some parts of the United States it is considered a serious agricultural pest.

EXTENDING THE ACTIVITY:

Many of the following discussion questions are intended to help participants better identify their interests, concerns, attitudes and feelings about endangered species. Thus, these questions are deliberately open-ended with no precise right or wrong answers.

1. Which would you rather see? (Rank order from first to last choice.)
   a. eagle b. deer c. moose d. wolf e. screech owl
   What are the reasons for your choice?

2. How do your feel about the hunting of animals for human purposes?

3. What can a person your age do about protecting endangered species?

4. What should other people do to protect endangered species?

5. Which of the following do you believe to be most important? Rank them from most important to least important.
   a. Protecting endangered species
   b. Finding a cure for cancer
   c. The space program
   d. Developing ways to use sewage in agriculture

6. What living things do you care most and least about? What are the reasons for your choices?

MYSTERY BIRDS CHART

	LIFE HISTORY CATEGORIES	SPECIES A	SPECIES B
1.	Size	Large	Small
2.	Range	No. America	No. America, Central America, and northern South America
3.	Time to reach adulthood	3-5 years	1 year
4.	Lifespan of adult	20-40 years	2-3 years
5.	Food	Fish and small mammals	Insects and seeds
6.	Number of mates: pair	1 male: 1 female	1 male: 2-3 females
7.	Size of breeding territory	Large	Small
8.	Nesting habitat	Large old trees or cliffs; large water areas	Wetlands, grasslands, grain fields or small grains
9.	Average young produced/ pair each year	1-2	3-4

DATA SHEET

Name ____________________ Date ______________

VARIATION WITHIN A POPULATION:
WHAT ARE YOUR TOLERANCES?

Check a number for each life requirement continuum.

a. Temperature
For the following room temperature levels, indicate your preference.

1 2 3 4 5 6 7

low ________________________________ high

Room Temperature

b. Density (Number of People per Unit of Area)
For the following density levels of people, indicate your preference.

1 2 3 4 5 6 7

low ________________________________ high

Density

c. Light
Indicate the amount or intensity of light vs. darkness you prefer.

1 2 3 4 5 6 7

limited ________________________________ abundant

Light Intensity

d. Food
Indicate whether you would prefer a lot of different kinds of food or only one or a few kinds of food.

1 2 3 4 5 6 7

limited ________________________________ high

Variety of Food

e. Protection.
Indicate the type of shelter (degree of complexity) you prefer.

1 2 3 4 5 6 7

crude ________________________________ complex

Type of Shelter

DATA SHEET 2

Mystery Birds: A Real Problem

My prediction: The most abundant species is ______________________________
because (list some reasons).

PURPOSE: To investigate the major causes for endangering the existence of plant and animal species.

LEVEL: Junior - Senior high school

SUBJECTS: Biology, Environmental Studies, Social Studies

CONCEPTS: The protection and management of endangered species varies between species.
There are many influences that lead plant and animal species toward endangered status.

MATERIALS: List of endangered and threatened species for each participant.

ACTIVITY:

1. Distribute a current list of endangered and threatened species to each participant. Suggested sources for obtaining such a list include: U.S. Office of Endangered Species, U.S. Fish and Wildlife District offices, State Department of Natural Resources, Audubon Society, Sierra Club. You may wish to use the lists on pages 257-262.

2. Have each participant select one species from the list, trying to avoid repetition of species. Make sure that plants as well as animals are selected.

3. Allow research time, and ask each to prepare a one-page summary on the status of his or her chosen species. The summary should include: the name of the species, the location in which it is found, its status (threatened or endangered), numbers in existence, major causes for the dangers the species faces, and current management and protection practices. If possible, pictures of the species should also be included.

4. Create a display of the summary sheets. Try to obtain permission to put the display in a public place, such as a local school or community center. (You may want to obtain this permission in advance.)

DISCUSSION:

1. What are the major causes resulting in endangered or threatened status for plant and animal species?

2. What role do people play in bringing about the changes that cause endangerment?

3. How does the extinction of a species affect the rest of the world ecosystem?

4. Does the extirpation (extinction in one state, where the species still exists in other areas) of a species have the same effect?

5. What can individuals do to help protect endangered species? Do individuals have a responsibility to take part in the protection of endangered species?

6. When is the survival of another species more important than continued human development? Less important?

EXTENDING THE ACTIVITY:

1. Invite representatives from organizations such as the local Garden Club or Greenpeace to speak to the group about their efforts to save a particular endangered species.

LIFESTYLE AND
ENVIRONMENT

PURPOSE: To think about what students consider to be necessary for them to lead the "good life" and sort out deepseated feelings toward material wealth.

LEVEL: Upper elementary - Junior high school.

SUBJECT: Social Studies.

CONCEPT: Some items considered important for a comfortable lifestyle are less necessary than others when environmental consequences are considered.

REFERENCE: Miller, 1979, pp. 11-13.

MATERIALS: Handout (Items for the "Good Life")

ACTIVITY:

Step 1. Distribute one copy of the handout to each student. Ask students to fill out the handout individually.

Step 2. Divide into groups and have each group come up with a list of items "necessary" for the good life. Check those items your group would be willing to give up.

DISCUSSION:

1. Can students find good reasons to need these items?
2. Which items are most commonly listed as essential to living the "good life"?
3. How many of the items on the list are sold by ads which promote the "good life"?
4. Why are students willing to give up certain items? How do they feel about giving up certain items?
5. Did the "have" column come close to matching the "good life" column? Can students explain the difference?
6. Can students account for differences of opinion on the "good life"?
7. Do students think that people in other cultures would agree with the class's list of essentials for the "good life"?
8. Which items are associated with food; which with energy resources?
9. How much would your class's list contribute to the depletion of natural resources?

EXTENDING THE ACTIVITY:

1. Obtain a collection of expendable old magazines and catalogs. Cut out pictures of items on the list of essentials and post around the room. If students must limit the list of essentials to ten, which ones would they choose?

2. Hand lists of items "necessary" for the good life around the room. Return to the lists at a later time and re-evaluate. Would you make any changes on the original lists? Why?

ITEMS FOR THE

"GOOD LIFE"

Name of Items	Which do you have?	Which do you think are necessary for you to live the "good life"?	Which items you have would you be willing to give up?

PURPOSE: To design and build a "Model City of the Future".

LEVEL: Junior high school

SUBJECT: Social Studies, Science, Math, Industrial Arts

CONCEPT: Land use policy is determined by the interaction of science and technology; social and political factors; and esthetic, ethical, and economic considerations.

REFERENCE: Junglas, Mary R. *et al.*, 1974.

MATERIALS: Scrap tin cans, egg cartons, milk cartons, straws, toothpicks, popsicle sticks, cottage cheese and sour cream containers, paper, glue and paint, styrofoam used for packing fragile items, throw-away flower pots.

ACTIVITY:

Suggest to your class that they design and build a model City of the Future according to the following criteria:

1. Dwellings will probably have to be high-rise apartments. On the roofs put recreation areas, green houses, swimming pools and tennis courts. Use bicycles for individual transportation and bicycle paths. You must have grass and trees and very little concrete. Water runs off concrete. Without grass and trees there is no absorption of carbon dioxide or generation of oxygen. Provide electric vehicles, a mono-rail system, a subway system for transportation, and a travel center outside the city to rent cars, boats, motorcycles, recreational vehicles or to take a plane. Provide areas for each person to do personal gardening.

2. Building the City

   Students make all the parts of the city as individual units. Do not try to put them all on a base. They usually turn out too big to do this. Set up the whole city on as large a space as is available. Then examine, criticize, and complement it.

3. Criteria for the Site

   Select a site for a city of ½ million people, large enough to be able to provide government, cultural, recreational and educational services, but not too big to be unwieldy. Select a climate conducive to human comfort, one which provides raw materials available for heavy industry and a location at least 100 miles from any other metropolitan area. Remember to find a means of generating electricty and/or other power sources available. Existing transportation should be nearby, as should recreation facilities for outside recreation which needs large spaces, such as boating and skiing. A water supply should be available. The city must be contained within 100 square kilometers.

4. All specifications must be written in metric units.

Specifications must include the following:

- Housing allotment (size and types of homes)
- How people are grouped (age, interests, family?)
- Where everything is located in the city according to the most efficient plan.
- Distances between things in the city
- Amounts of waste water which will be produced
- Building materials which are available on or near site
- Exact location of the city (latitude and longitude)
- Climate of the location; waterways and mountains nearby; elevations

5. Model City of the Future must include the following features:

-Heavy density for dwellings, high convenience transportation

-Large amounts of open spaces within boundaries

-Many parks and plantings (plantings to suit location of site)

-Selection of major industries and subsidiary industries to fit site

-A means of transporting the required materials if they are not available

-No streets; only walking paths and small vehicle paths in concrete

-Some type of futuristic transportation system which is convenient

-No internal combustion engines for transportation within the city

-Buildings which are made of materials which suit the site

-Water supply--unpolluted; sewage disposal plant; solid waste use; recycling or disposal means

-Governmental agencies; fire control, government, law enforcement

-Occupations to employ at least one-third of the population

-Cultural areas; recreation areas; hotels for visitors; restaurants

-Elementary; high school; middle school; college educational plan (describe the educational system and the locations)

-Libraries and other learning centers for those not in school

-Shopping areas convenient to homes, larger central shopping area (consider computer shopping)

-Computer system

-Individual garden areas, patio and/or outdoor areas for all

-Parking area on outskirts of city for visitors

-Travel center to use in leaving city or returning

-Outside--large space-recreation areas

-Communications system within city; outside of city

-Energy sources for heat, light, to be futuristic if possible

As a class, examine Atlases to choose the site for the city.

Now divide class into groups to research the following specific topics: transportation, water supply including sewage disposal, housing, cultural areas, energy, industry and open spaces and recreation. Each group will be responsible to write up the specification on their particular topic.

The following resources may be of help for this portion of the project:

a. Department of Housing and Urban Development (HUD), Washington, D.C. Request information and statistics on present programs on city planning, development and rejuvenation.

b. Environmental Protection Agency (EPA), Washington, D.C. Request information about control of ecological problems.

c. NASA, Lewis Research Center, Brookpark Road, Cleveland, Ohio. Request information on technological utilization.

d. Chamber of Commerce, Reston, Virginia. Request information about their modern transit system to Washington, D.C.

e. Mayor of the City, Chicago, Illinois. Request information about new apartment buildings above switching station of Illinois Central Railroad.

f. I.B.M. Public Relations Department, Utica, New York. Request student kits on how a computer works.

g. NASA, Lewis Research Center, Brookpark Road, Cleveland, Ohio. Request information or booklet on computer programming of software.

After the topics have been researched, help the students draw a plan for their city on a large sheet of white paper, include everything that will be in the city, and color key the drawing to be sure that they know what each item is. Use metric units for distances.

Students can now build parts of the city separately, and paint or color them if necessary. Use only throwaway items to build the city; no commercial items are permitted (e.g., those little houses and trees that are used in model railroad layouts).

DISCUSSION:

1. How does this model city of the future compare to the city you live in?

2. What difference would it make to the world environment if all cities were built according to the criteria set up for this future city?

PURPOSE: To encourage students to consider ways everyday choices reflect lifestyles and values.

LEVEL: Junior-Senior High School

SUBJECTS: Science, Social Studies, Mathematics

CONCEPT: Supply and demand in relation to the values and needs held by society determine what is a resources and its economic values.

REFERENCE: American Forest Institute, 1977b.

ACTIVITY:

Duplicate this questionnaire, or develop your own, and distribute it to your students.

Given the choice, which would you prefer?

Formica with simulated wood grain	or polished solid wood
Metal sculpture	or wood carving
Plastic toys	or wooden toys
Metal kitchen cupboards	or wood kitchen cabinets
Artificial logs with gas flame	or fireplace wood
Gas burner stove	or camp cooking or wood fires
Aluminum canoe	or laminated wood canoe
Fiberglass-hulled boat	or wood-hulled boat
China bowl	or wood salad bowl
Aluminum ladder	or wood ladder
Chain-link fence	or wood-slat fence
Cement patio	or wood decking
Aluminum outdoor furniture	or redwood furniture
Plaster walls	or wood-paneled walls
Stucco siding	or shake shingle siding
Glass bottle (returnable)	or paperboard carton
Glass bottle (recyclable)	or paperboard carton
Glass bottle (nonreturnable)	or paperboard carton
Metal clothes hangers	or wood clothes hangers
Metal baseball bat	or wood baseball bat
Plastic picture frames	or wood picture frames
Wall to wall carpeting	or wood floors
Plastic Christsmas tree	or a living coniferous Christmas tree
Paper towel	or cloth dish towel
Paper cup	or plastic cup

After the students have completed the questionnaires, encourage them to discuss their responses. Explore the feelings, ideas and information they feel affected their selections. Discuss questions such as the following:

> What factors influenced your choices?

Did the way in which you planned to use the item influence your decision? Did the item's price influence your chioce? Its aesthetics? Its durability or performance?

Can you identify any trends shown by your choices?

Then ask your students to find out (1) how much energy is required to manufacture and use one of the products or materials they chose; (2) the relative environmental impact of its manufacture and use; (3) the comparative retail price of each item; (4) its renewability, reusability, and recyclability; and (5) the impact of the item's manufacture and use on the nation's economy.

DISCUSSION:

How does information related to the energy requirements and environmental impact influence your preference?

On reflection, did you consider these factors when you made your decision?

Would the other item, if you had chosen it, have more or less impact on the environment? On energy consumption? On the economy?

What trade-offs, if any, are involved in the selection of such products?

Which items, if any, do you need to survive? Which could easily be eliminated?

How do your choices reflect your lifestyle and values?

PURPOSE: To speculate about the positive and negative global effects of a single development.

LEVEL: Senior high school - Adult

SUBJECT: Social Studies

CONCEPT: The effects of any decision inevitably bring about more changes than we can anticipate.

REFERENCE: Victor and Kraft, 1976, pp. 11-13.

In a story entitled "What If," Isaac Asimov explored what would happen if a slight change in circumstances had prevented two people from meeting at a particular moment in time.

We can use Asimov's question "What If?" to help us evaluate the possible global consequences of political and social developments. The "What If's" below are designed to have participants speculate about the positive and negative global effects of a single development. To do this, participants will also need to anticipate the problems and needs of a future world. In this way, they will be encouraged to look at our present situation and actions in light of possible futures we may confront.

True, the effects of any decision inevitably bring about more changes than we can anticipate, something Robert Hanvey has referred to as the "hidden wiring." Yet, by thinking in this manner we will less likely be surprised by the secondary and tertiary consequences which follow from a decision. For example, what would happen if the United States adopted an isolationist policy? Would millions of people throughout the world starve? Would our allies turn from us to the communist countries? Would some of our present allies, such as Israel, be taken over? Would our standard of living drastically change? How would the world economy be affected? Would other nations receive more oil? What else?

ACTIVITY:

1. In small discussion groups, or in a general group discussion, have participants speculate about the possible global effects of one or more of the "What If's" below.

2. What personal actions can be taken to help prevent some of the negative results from occurring or to help bring about some of the positive results?

VARIATION:

Divide the group into small discussion teams and allow each team to choose a different "What If" question from the following list. List or diagram the possible global effects, and share the results with the remainder of the group.

WHAT IF'S?

1. What if the United States' grain production were suddenly reduced by 50%?

2. What if all forms of private transportation were banned and only public transit systems were allowed?

3. What if all nations had to share their energy and food supplies?

4. What if the governments of all nations banded together to pass a law that couples would be sterilized after their second child?

5. What if Arab oil exports to Europe and Japan were stopped?

6. What if the world's population continues to grow at its present rate which doubles the world's population about every 34 years?

7. What if pollution kills off the majority of plankton and green plants in the coastal areas?

8. What if Communist China develops the same nuclear strike capabilities as the United States or the U.S.S.R.?

9. What if all pre-school children were required to attend day care centers run by the government?

10. What if people who were no longer economically productive (over 65, for example) were disposed of?

11. What if Arab countries were only to trade their oil for technological assistance (including assistance in the area of nuclear development)?

12. What if, by the year 2000, all people were forced to live in cities of 100 story buildings?

13. What if people were paid in food instead of money? ...were paid for their labor on a social utility scale? What if those who contributed most to society, regardless of their jobs, were to be paid the most? ...a farmer in Sahel, Africa, were to receive the same pay as a farmer in the United States?

14. What if countries pollute the land, air and water to acquire more energy at less cost?

15. What if pollution along the Japanese coast cut fish production (their main source of food) by 50%?

16. What if waste from an atomic reactor in a small town in Belgium were to contaminate an area of 300 square miles?

17. What if each state or city had its own foreign policies?

18. What if the prices of natural gas, oil, and electricity double in the next ten years?

PURPOSE: To examine the developing gap between economically rich and poor countries.

LEVEL: Senior high school - Adult

SUBJECT: Social Studies, Economics

CONCEPT: As the gap between rich and poor widens, the world is polarizing along economic lines into two camps. As Lester Brown stated in World Without Borders,*

> In effect, our world today is in reality two worlds, one rich, one poor; one literate, one largely illiterate; one industrial and urban, one agrarian and rural; one overfed and overweight, one hungry and malnourished; one affluent and consumption-oriented, one poverty-stricken and survival-oriented.

REFERENCE: Millar, 1973, pp. 22-23.

MATERIALS: One large copy of The Development Gap chart; copies of Living on Less than Two Hundred Dollars a Year and the Parable for each participant.

ACTIVITY:

1. See if anyone in the group can describe from something they have observed or experienced here or in another country, what it is like to be really poor. Display The Development Gap Chart for participants to examine.

2. Discuss the Development Gap Chart. The following questions can start discussion:
   a. What are the differences in per capita GNP between developing countries and the U.S.? What does this mean in practical terms of personal and home life?

   b. Note the statistics on life expectancy, infant mortality, and people per physician. What do they tell you about health conditions in developing countries?

3. Read Heilbroner's description of life in a developing country, "Living on Less than $200 a Year." Ask participants if they feel any responsibility to help people who are living under such conditions.

4. Read the parable. (A parable is a short, simple story from which a moral lesson may be drawn.)

5. Discuss the parable, using the following questions as a basis for discussion:

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*Lester R. Brown, World Without Borders (New York: Random House, 1972), p. 41.

a. What is the meaning of the parable?

b. What values does the parable bring out?

c. What does this parable have to say about setting priorities?

d. Who are The Brothers? The Others?

e. According to the parable, what are the consequences of the Brothers' actions?

f. What implications does it have for global development and American foreign relations?

THE DEVELOPMENT GAP

INDICATOR	DEVELOPING COUNTRIES	DEVELOPED COUNTRIES	UNITED STATES
Per Capita GNP	$230	$3,085	$4,756
Population (millions, mid-1971)	1,850	664	207
Population Growth Rate	2.6%	1.1%	1.1%
Literacy	40%	97%	98%
Calorie Consumption	2,180/day	3,030/day	3,150/day
Life Expectancy	52 yrs.	71 yrs.	70 yrs.
Infant Mortality (deaths per thousand live births)	110	22	19
People per Physician	3,400	700	620
Per Capita Power Consumption (annual KWH output per person)	220	5,140	8,000

Source: U.S. Agency for International Development, "Development and Humanitarian Assistance, FY 1973 Program Presentation to the Congress," p. B-1; and U.S. Agency for International Development, "Selected Economic Data for the less Developed Countries," June 1972, p. 8. Reprinted from The United States and the Developing World: Agenda for Action (Washington, D.C.: Overseas Development Council, 1973), p. 123.

LIVING ON LESS THAN TWO HUNDRED DOLLARS A YEAR*

In his book, The Great Ascent, the well-known scholar Robert L. Heilbroner uses a simple but most effective technique for conveying the idea of just what it means to live on from $50 to $200 per year. He starts with a typical Canadian-American family, with an income of $6000-$7000 per year, in a small suburban home. Then he refashions this home, and the life of its inhabitants, into a typical scene in the vast "under-$200" areas of the world:

1. Take out the furniture, except a few old blankets, a kitchen table and one chair.
2. Take away all the clothing, except for the oldest dress or suit for each member of the family, and a shirt or blouse. Leave one pair of shoes for the head of the family.
3. Empty the pantry and refrigerator except for a small bag of flour, some sugar and salt, a few moldy potatoes for tonight's dinner, a handful of onions and a dish of dried beans.
4. Dismantle the bathroom, shut off the water, remove the electric wiring.
5. Take away the house itself, and move the family into a toolshed.
6. Remove all the other houses in the neighborhood, and set up in this place a shanty-town.
7. Cancel all subscriptions to newspapers, magazines and book clubs. This is no great loss, as our family is now illiterate.
8. Leave one small radio for the whole shanty-town.
9. Move the nearest clinic or hospital 10 miles away and put a midwife in charge instead of a doctor.
10. Throw out the bankbooks, stock certificates, pension plans and insurance policies, and leave the family a cash hoard of $5.
11. Give the head of the family 3 tenant acres to cultivate. On this he can raise $300 in cash crops, of which one-third will go to the landlord and one-tenth to the local moneylender.
12. Lop off 25 to 30 years in life expectancy.

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*Reprinted from FAO Magazine Freedom From Hunger, July-August 1965.

PARABLE[*]

There once was a man who had a rich property. He gave it to his children to care for. Because the father loved his children, he left on a long journey and gave them real freedom to organize his property their own way.

Now part of that property was cultivated and another part was not. The sons who lived on the richer part built fences to defend their section from the others who lived on the wild parts. They led a good life themselves, and once in a while threw food over the fence so that the other children at least knew life could be good.

Then the children on the other side of the fence sent a delegation to their brothers and said: "Teach us how to cultivate our soil, and while we learn, share your riches with us so that we do not die." But the Brothers replied, "Go away; there is not enough for all of us. Learn to till the soil yourselves."

The Others: "We will do that, but we have no tools to till the soil. Help us with your tools."

The Brothers: "We cannot do that, because we need all we have if we want to keep our standard of living. We'll give you a few tools, and with them you can make your own."

The Others: "In order to make tools we need money. Buy what we have reaped on our land and we shall buy our own tools from you."

The Brothers: "But we don't need products. If you sell them to us our economy will be disrupted."

The Others: "But then what shall we do; our wives and our children are dying?"

The Brothers: "It will take time."

The Others, seeing that their brothers did not really want to help them, stormed the fence, broke it down, took the food they needed, and killed all the brothers who resisted them.

Then the owner of the property returned and was both angry and sad. To the surprise of the children who had lived behind the fences, he put The Others in charge of the whole property and forgave them their violence.

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[*] This parable appeared in the Fall 1970 edition of "Ways and Means of Teaching about World Order," a publication of the Institute for World Order, 11 West 42nd Street, New York, New York 10036. The parable was contributed by Kin Mason of Mount Elizabeth Secondary School, Kitimat, British Columbia.

REFERENCES

Acid Precipitation Awareness Program. 1980. Trial Acid Precipitation Materials, Grades 7-12. Minneapolis: Minnesota Environmental Education Board.

American Forest Institute. 1977a. Project Learning Tree: A Supplementary Curriculum Guide for Grades K-6. Washington, DC: American Forest Institute.

American Forest Institute. 1977b. Project Learning Tree: A Supplementary Curriculum Guide for Grades K-12. Washington, DC: American Forest Institute.

Ambry, Edward J. 1976. Food-The Coming Crisis (Grades K-12). Upper Montclair, NJ: New Jersey Council for Environmental Education, Montclair State College. ED 162 885.

Bowman, Mary Lynne. 1979a. Teaching Basic Skills through Environmental Education Activities. Columbus, OH: ERIC/SMEAC. ED 196 704.

Bowman, Mary Lynne. 1979b. Values Activities in Environmental Education. Columbus, OH: ERIC/SMEAC. ED 182 118.

Bowman, Mary Lynne, and Herbert L. Coon. 1978. Recycling: Activities for the Classroom. Columbus, OH: ERIC/SMEAC. ED 159 075.

Bowman, Mary Lynne, and John F. Disinger. 1977. Land Use Management Activities for the Classroom. Columbus, OH: ERIC/SMEAC. ED 152 541.

Bureau of Land Management, U.S. Department of the Interior. 1971. All Around You: An Environmental Study Guide. Washington, DC: Bureau of Land Management. ED 064 131.

Community Environmental Education Center Activities. 1980. Ann Arbor: University of Michigan, School of Natural Resources.

Coon, Herbert L., and Mary Lynne Bowman. 1978. Energy Activities for the Classroom, Volume II. Columbus, OH: ERIC/SMEAC. ED 173 072.

Coon, Herbert L., and Mary Lynne Bowman. 1976. Environmental Education in the Urban Setting: Rationale and Teaching Activities. Columbus, OH: ERIC/SMEAC. ED 137 140.

Fielder, Erica, and Carolyn Shaffer. 1976. Ecology for City Kids. San Francisco, CA: San Francisco Ecology Center. ED 183 321.

Gail, Peter A., et al. 1974. A Curriculum Activities Guide to Watershed Investigations and Environmental Studies. Cleveland, OH: Institute for Environmental Education. ED 104 561.

Giebelhausen, Maribeth R., et al. 1973. Trash--Our Only Growing Resource. Chesterfield, MO: Parkway School District. ED 098 070.

Grooms, Harold. 1972. Environmental Education Exercises, Junior High. Paris, KY: Bourbon County Schools. ED 081 614.

Hernbrode, William R. 1978. Multidisciplinary Wildlife Teaching Activities. Columbus, OH: ERIC/SMEAC. ED 162 897.

Jamason, Barry W. 1977. Environmental Quality: A Community Concern. Albany: New York State Department of Education. ED 148 566.

Johnson, Jacqueline, and John Benegar. 1981. Global Issues in the Intermediate Classroom. Boulder, CO: Social Science Education Consortium. ED 209 125.

Junglas, Mary R., et al. 1974. Environmental Learning Experiences, Biophysical, Junior High School. Willoughby, OH: Center for the Development of Environmental Curriculum. ED 099 229.

Kesselring, Daniel F., and Janice Moore. Undated. Pollution Inventory: Things to Look For. Westland, MI: Soil Conservation Service, USDA.

King, Pat, and John Landahl. 1973. Teaching Pollution Concepts. Olympia, WA: Office of the State Superintendent of Public Instruction.

Kohuth, Barbara, and Boyd T. Marsh. 1974. An Educational Guide for Planning an Improved Human Environment. Hudson, OH: Inner Circle Press, Inc. ED 141 081.

Liston, Mary Dawn. 1980. The City and Natural Systems. Paris: Unesco.

Millar, Jayne. September 1973. "Development: Alternative Priorities for the Future." Intercom, 73, 22-24.

Miller, Barbara. 1979. Thinking Globally, Acting Locally about Food, Population, and Energy Issues, 7th Grade Interdisciplinary Unit. Aurora, CO: Aurora Public Schools. ED 199 120.

Minnesota Environmental Sciences Foundation, Inc. 1975. We Can Help: Environmental Education Teaching Resources, Teacher's Guide and 24 Outdoor Classroom Environmental Education Guides. Minneapolis, MN: Jenny Publishing Company, Inc. ED 183 368.

New York State Department of Education. 1977. An Environmental Syllabus, Grades 10-11-12. Albany: New York State Department of Education. ED 139 671.

Parker, Sylvia, Irma Allen, Bennie Bezuidenhout, Chiverage Chimombe, Ray Choto, Andy Crabb, Lynne Dunstan, and Roz Heberden. 1982. Environmental Science and Agriculture, Teacher Resource Book, Grade 6. Salisbury, Zimbabwe: The College Press.

Parker, Sylvia, Bennie Bezuidenhout, Chiverage Chimombe, Andy Crabb, and Roz Heberden. 1981. Environmental Science and Agriculture, Group Activity Book, Grade 6. Salisbury, Zimbabwe: Longman Zimbabwe (Pvt) Ltd.

Richardson, Robin. 1977a. Caring for the Planet. World Studies Project, One World Trust. Sunbury-on-Thames, Middlesex, United Kingdom: Thomas Nelson and Sons, Ltd.

Richardson, Robin. 1978. Fighting for Freedom. World Studies Project, One World Trust. Sunbury-on-Thames, Middlesex, United Kingdom: Thomas Nelson and Sons, Ltd.

Richardson, Robin. 1977b. World in Conflict. World Studies Project, One World Trust. Sunbury-on-Thames, Middlesex, United Kingdom: Thomas Nelson and Sons, Ltd.

Roller, Lib. 1972. Using the School and Community. Nashville, TN: Nashville Metro Schools Environmental Education Department. ED 071 917.

Roth, Charles E., and Linda G. Lockwood. 1979. Strategies and Activities for Using Local Communities as Environmental Education Sites. Columbus, OH: ERIC/SMEAC. ED 194 349.

Schatz, Albert, and Vivian Schatz. 1971. Teaching Science with Garbage. Emmaus, PA: Rodale Press, Inc. ED 073 904.

Schultz, Judith M., and Herbert L. Coon. 1977. Population Education Activities for the Classroom. Columbus, OH: ERIC/SMEAC. ED 141 178.

Stapp, William B., Karen Rutledge, Paul Zeph, and Karen Zimbelman. 1981. A Community Transportation Curriculum Module. Ann Arbor: University of Michigan, School of Natural Resources.

Strategic Environmental Planning. 1977. Internet: International Environmental Resources Network Teachers Guide. Concord, MA: Threshold, Inc.

U. S. Department of the Interior, Fish and Wildlife Service. 1980. Endangered Species Issue Pac. Washington, DCP USF&WS Office of Extension Education.

Victor, David, and Richard Kraft. 1976. Global Perspectives Handbook, Experimental Edition. Bloomington: Indiana University, Mid-America Program for Global Perspectives in Education. ED 115 558.

Wahl, Mark. 1974. Two-Wheel Math: An Application Module. Denver, CO: University of Denver Mathematics Laboratory, Regional Center for Pre-College Mathematics. ED 183 413.